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From an Architect's Sketch-Book

By Samuel Chamberlain

Illustrated with Sketches by the Author

POITIERS

FOR some reason, not easily explained, the calm city of Poitiers is much less frequented as a centre for tourists and architects and vagabond sketchers than its northern neighbor, Tours. Here is quite as much charm, quite as delightful an assortment of architectural monuments, a more decided picturesqueness, and all the cafés are fully as well stocked. It's all very inexplicable.

Those Americans who are accustomed to rolling across the monotonous Montana wastes on a Pullman for days at a time, with never a change of landscape, must marvel at the rapid transformation that can be noted in taking such a ridiculously short jaunt as that from Tours to Poitiers. Every kilometre to the southward proclaims itself in some slight change in the character of the country. Gradually the roofs turn redder and the blue slate of Touraine fades into the background. The wall surfaces seem to add a lustre of buff and to appear more sun-baked. Arrived at Poitiers and the last vestige of Brittany seems to have flown. A lace bonnet becomes a rarity, and a faint suggestion of Spanish influence seems to assert itself. The happiest manifestation, perhaps, is that the countryside becomes dotted with lovely old Romanesque churches. Poitiers itself is far from neglected in this respect.

The very character of the people seems different. Poitiers has many touches of Paris, not the least gratifying of which are its dazzling and well-dressed women. Evidently the mode of the moment has very much of a hold here, for a goodly share of the population is far removed from sabots and shawls.

Poitiers is built on a most impressive plateau which darts up from the valleys at its base by means of huge buttressed walls and a tangled assortment of steep cobbled roadways. One's initial impression from the railway-station, upon being confronted by the vast gray precipice of retaining wall and the sombre buildings that cap it, is that here indeed is a walled town worthy to rival Carcassonne. Such lofty expectations are doomed to disappointment, however, for Poitiers is a bit disjointed and aimless inside its confines. Acute angled intersections seem to be the accepted thing for most of the streets, and without the aid of a compass or an intuitive hunch as to the location of the north star, it is next to impossible to retain a sense of direction. The only way to arrive at any of the several charming squares of the town is to stumble upon them. Scattered in among the buildings of past centuries is an unusually large number of modern stores and apartment-houses, done in the approved Paris manner. Some of them are gruesome to a degree, although a most interesting and successful experiment has been performed in the new post-office. Given a flat-iron-shaped lot, few architects could have arrived at a more expressive solution. There is a most impressive hotel too, gaunt and a bit cumbersome, which houses a whole regiment of blasé and excessively bored caryatides on its grimy façade.

The churches of Poitiers, from the Gallo-Roman Baptistère Saint-Jean to the pathetically terrible modern Protestant temple, form a rather complete history of ecclesiastical architecture in themselves. Few cities could be richer in Romanesque monuments. One of the most ancient churches in all France is the fourth century Baptistère Saint-Jean, which

CHATEAU DE TOUFFOU
NEAR POITIERS

of stone, the beholder does not easily overlook or forget the scale of Saint-Pierre.

Jutting out in the middle of the important Rue Gambetta is another Romanesque tower of extraordinary beauty of proportion, the church of Saint Porchaire. The grace, the structural sturdiness, the light and shade value of the round arch are happily evident here. Beyond the tower, however, is a bisected appendage that is pretty much of a hodge-podge.

The uniquely planned Church of Saint-Hilaire-le-Grand presents alternate fragments of the finest developments in Romanesque design and great blocks of dreary and soulless restoration. Nevertheless, this church is archæologically more intriguing than any of the others.

But more famous than the rest, largely on account of its incomparable façade, one imagines, the eleventh century church of Notre-Dame-la-Grande attracts the visitor's attention above all. Its fantastic, cone-like minarets lend a fascination to its profile. Its gaudily painted interior achieves an unbelievable harmony, and its setting in the midst of a bustling, haphazard, and highly picturesque market-place tends to classify Notre-Dame-la-Grande as somewhat unique among churches. One becomes conscious of a terrific temerity in discussing the façade, for it is utterly, matchlessly superb. It is most gratifying to note the appreciation heaped upon it by all nationalities of tourists alike.

Poitiers is well endowed with monuments other than its churches, notable among which are the time-blackened remains of a splendid old classic doorway known as the Porte des Augustins. Few finer bits of Corinthian architecture can be found in France, and were I earnest enough to essay an elaborate measured drawing, this beautifully detailed portal would be my first and most enthusiastic choice.

The very disjointed Palais de Justice, which makes its initial bow with a stolid Doric portico and parades forth strange and liberal-minded Gothic for the final curtain, is now sunk far below the level of the street, the accumulations of ages having gradually snowed it under. On the exterior only fragments of the original stone and brickwork appear imbedded in the quite authentic but singularly cold restoration. Inside there is a different story. The splendid old vaults are standing as originally built. A most fascinating collection of Roman objets d'art and implements is found in the dim interior of the Baptistère, lovingly cared for by a dusty, flea-bitten, mouldy old custodian who will talk endless hours about his hobby if one but gives him a look of encouragement.

More famous as a shrine than any of the churches of Poitiers is the secluded Romanesque church dedicated to Sainte Radegonde. It has a splendid Gothic entrance portal, about which are always clustered beseeching old women vending candles to be burned over the dingy shrine of Sainte Radegonde. This subterranean shrine, incidentally, is approached rather uniquely by a broad stairway which begins to descend squarely in the middle of the nave at the crossing with the narrow transept. Everywhere on the walls are plastered innumerable white marble slabs of thanks to the saint after whom the church is named.

The tremendous cathedral Saint-Pierre, so reminiscent in spots of early English perpendicular Gothic, is so noble and significant that one wonders why such comparatively little mention is made of it in the writings on French Gothic. The interior is barren and frigid, but the scale of the whole vast enterprise is so great that such trifles are overlooked. Nowhere is the magnitude of the structure better brought forth than on the astonishing east elevation, where a colossal sheet of wall surface bounds up vertically without the trace of a buttress, without any apparent hesitation. Confroned by this smooth cliff

A REMOTE CORNER IN POITIERS.

A COUNTRY CHURCH NEAR LOUDUN
JULY 1

constitutes quite an architectural vaudeville show. It requires much conjuring of the imagination to figure the why and wherefore of three huge buttresses which plaster themselves squarely behind the flamboyant tracery of the south windows in the large and tomblike Salle des Pas-Perdus. Wandering farther one encounters several uncompleted towers, known collectively as the Tour Maubergeon. Here a series of draped statues managed to get on their crocketed pedestals ahead of the rest of the stonework, and they thrust their heads very jauntily above the improvised tile roof.

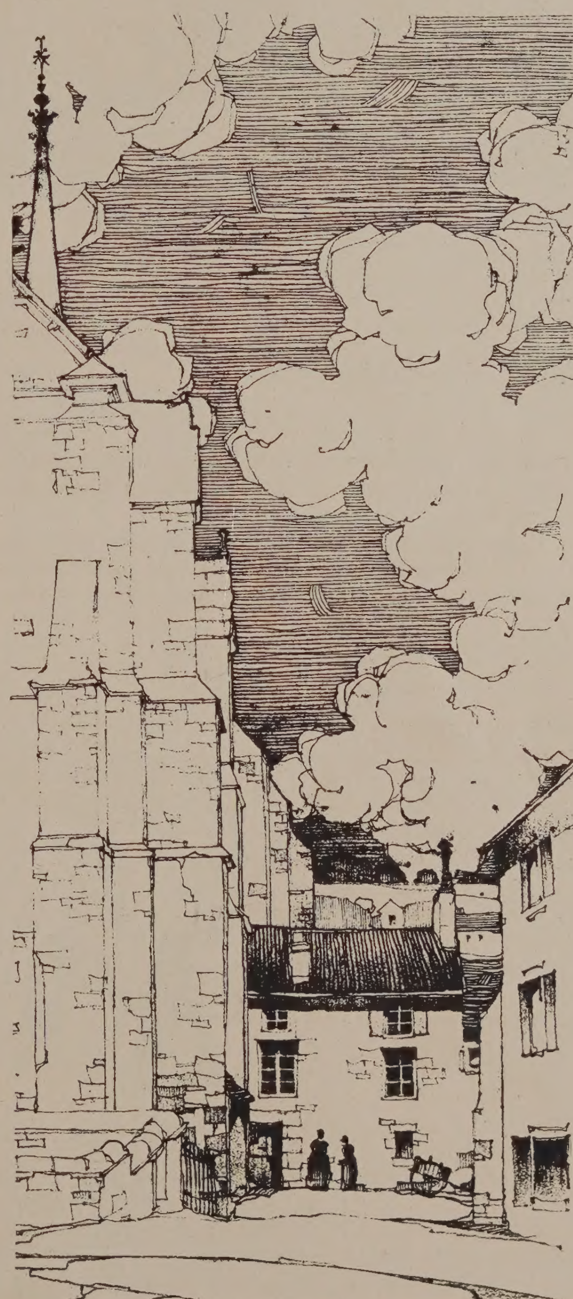
Poitiers, an ecclesiastical, judicial, and university centre, has more than its share of public buildings. There are many modern structures to contrast with the old and to remind one just a bit of Paris. The expansive Hôtel de Ville, with its array of expectant medallions, is one of the finest. It varies not a great deal from a hundred Hôtel de Ville solutions of the last few decades, but somehow there has been imparted to it a singularly vibrant and living quality.

To the roving architect, equipped with a bicycle and the accompanying zeal, Poitiers is perhaps most interesting as the centre of a network of innumerable villages possessing lovely bits of architecture, especially old Romanesque churches. Once in the country one notes a different character in the trees and fields. Everything seems a trifle scrubbier and the general effect is not so gardenlike as in Touraine. Detailed mention of the many worth-while villages close at hand would be tiresome, but a special bouquet must be presented to the charming Saint-Benoit, four kilometres to the south. It is thoroughly delightful, an unclouded joy to the impressionable visitor, while at Saint-Jouin-de-Marnes, a bit farther away, is the massive bulk of a handsome twelfth-century church which wafts one's enthusiasm almost up to the bursting point.

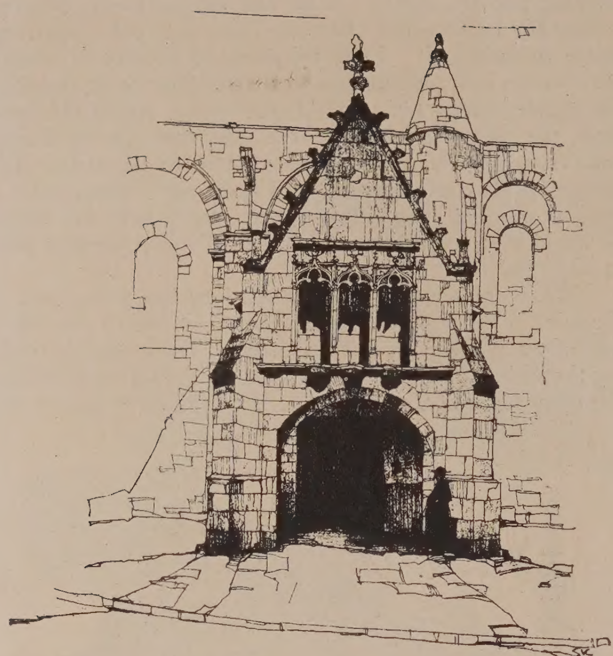
The environs of Poitiers are not heavily spotted with châteaux, but there are two worth going through much anguish to visit. One of them, the château at Dissais, greatly resembles Chaumont, but is nearly all a restoration. If you can brave the ire and frigidity of a very upstage Comte de Something-or-other who is lord and master of the estate, there is a vast and entirely idyllic expanse of grounds to be seen behind the muddy moat and glaring white walls of Dissais.

One wishes to be endowed with the appreciativeness of a Ruskin in speaking of the lovely, polychrome mass of the little-known château of Touffou. It is one of those intimate, inviting, imaginative gems that compel you to forget entablatures and mouldings, and to think of green fields and swaying poplars, tufted clouds and flaxen-haired children. Irresistibly its homelike character inspires in one a yearning desire to possess it. Everything about Touffou is lovely. the vine-covered pavilion known as the Tour Saint-Georges, the simple, sunny little chapel, the gaunt, feudal old dungeon, the terraces, the moat, the view that spreads before one, above all, the soft, sun-baked color of the walls. Iridescent pinks, soft browns, and gorgeous ochres, with a familiar touch of bug-killing mineral green here and there, all blend into a sparkling ensemble. Touffou needs a poet to do it justice.

While comparatively few Baedakers are to be seen in the hands of gaping tourists in Poitiers, it merits the affection of travellers as well as architects. There must be lacking that faint touch of the theatrical that often characterizes the rendezvous of the sightseers. Everything is done to aid



Beside L'Eglise Sainte Radegonde, Poitiers, July 10.



GOTHIC
SIDE DOORWAY
EGLISE DE NOTRE DAME LA GRANDE
POITIERS - JULY 7TH

POITIERS - JULY 8

the traveller, however. There is a travel bureau, very well informed, where a one-toothed lady with a heart of gold and an endless line of conversation makes it convincing that there is positively no part of France as charming as Poitiers. And there is the broad, inviting Parc de Brissac, where an easy-going public drinks leisurely bocks and listens to the music every evening. It need hardly be added that the boulevard cafés are excellent.

If only they would not serve every conceivable part of a butchered beast at the table, and eat goat's milk cheese to the exclusion of all others, the citizens of Poitiers would have everything of which to be proud.

THE CLOISTER AT SAINT-BENOIT
AUG 12

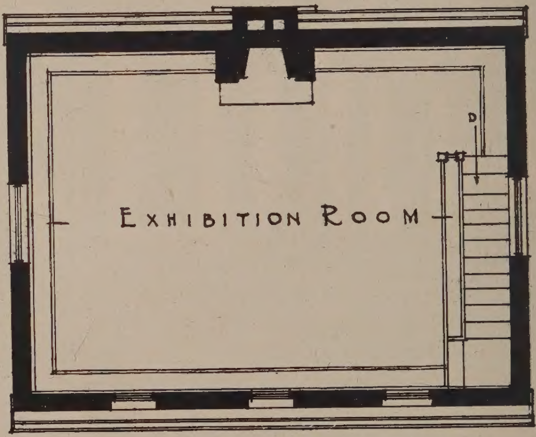
PUBLIC LIBRARY, KENT, CONN. Heathcote M. Woolsey, Architect.

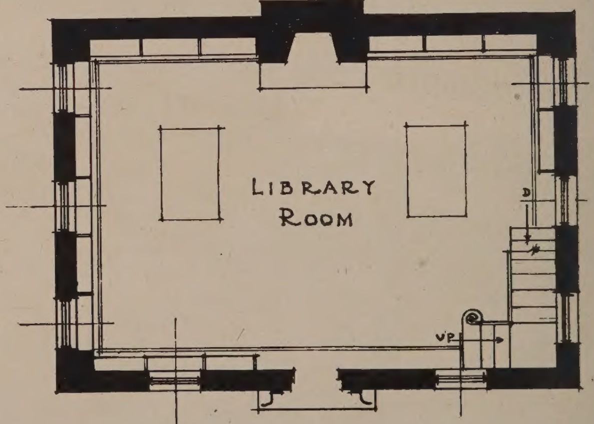
A soldiers' memorial erected by public subscription and the work of the Library Association.

LIBRARY ROOM.

LIBRARY ROOM.

MAIN ENTRANCE.





Heathcote M. Woolsey, Architect.

PUBLIC LIBRARY, KENT, CONN.

After Ten Years

A Chicago Architect's Impressions of Fifth Avenue and Some Recent Buildings

By William J. Smith

Of Childs & Smith, Architects, Chicago

Dear Editor:

If the great keynotes of American architecture—architecture of the last fifty years—are included in any street in America, probably your Fifth Avenue in New York would be that street. Perhaps Chicago's Michigan Avenue can some day compete for supremacy—but certainly not yet. Not till the number of careful works of art has increased on Michigan Avenue, and even then not till decades have passed as they have on Fifth Avenue, softening many of its masterpieces and stamping them with the approval of years.

After over ten years' absence to put foot again on Fifth Avenue between 34th and 59th Streets—to glance down its side streets—to do this in company with you and to hear your views—seems to me the best architectural tonic I could possibly receive.

Many years ago, as a student, I remember distinctly the criticism of a number of fellow students over the plates which I had gathered around me—tacked on the walls—while I was executing a projet. These plates were of buildings which had no reference to the projet I was working on, but by their excellence and masterful handling, by having them around me, they caused me to struggle somehow to reach them in quality and in freshness.

If I lived in New York to-day I confess I should not nndertake a single building projet without walking along Fifth Avenue or continually surveying buildings similar to those of its greater masterpieces, in order that they might likewise, although totally unlike my projet, inspire and make me ashamed not to endeavor in every way to equal them in fineness and in quality.

There are, of course, other buildings of equal merit with the best of your Fifth Avenue ones, but taken together these represent a complete spectrum of fine types of American architecture. Thus by standing at several spots along Fifth Avenue, looking north and south, one can see monumental buildings of varying character—the diversified expressions of each decade in the last fifty years, and the individual characteristics of our great architects. Almost like a Babson report, one can inspect the ups and downs of ornamental, decorative, and so-called original styles and the probable architectural tendencies of the future. Design pioneerings of our past have each cast their shadows before and notably on this thoroughfare.

Already are not the great store and shop fronts of Fifth Avenue, such as the Gorham Building, Tiffany's, Lord & Taylor's, Duveens'—those delightful fronts of Andrew Alexander, Edison, Black, Starr & Frost, and the Hampton Shops—are these not already the ancestors of many of our recognized fine department-stores and shops elsewhere throughout the country? Cannot one read into the club building successes elsewhere, touches of the character of the Union Club, University Club, the Harvard Club, at 44th Street, and the Knickerbocker Club and others on the rich by-paths of Fifth Avenue?

Cannot one see the church-building influence throughout the country of such as St. Thomas's? And of St. Thomas's is there not a wealth of craftsmanship shown in its reredos, in its tile and marble floors, in its woodwork, in its painting and decorations, in its wrought iron—a wealth which enriches every architect who comes to see them, especially when he comes to be sure his own projet is "up to quality"?

Our banks, the modern money cathedrals of America, have very fine types to study from and be influenced by on Fifth Avenue, including such classical types as the old Knickerbocker Building, the Bankers Trust, and the Postal Life, The Title Guarantee and Trust—such an Adam type as the up-town Guaranty Trust Co., at 60th and Madison Avenue, such a refreshing modern adaptation of the Byzantine, warm with color and quality—the Bowery Savings Bank.

When one plays with an architectural composition he can find notes on Fifth Avenue similar to almost any chords of harmony which he selects. He may have an architectural Bach fugue that only the intellectually gifted can truly appreciate, others passing it by as "dry and a classicist copy." Or does he wish a Grieg or a Wagner, full of color and emotion, that greets him with warmth and the human touch? All of these are here in various degrees and gradations. Originality! In some senses we are sick of the term. Architectural scientific invention in design seems to be the requisite very often in this scientific age. Such inventions are responsible for most of the ills that architecture has been heir to in the last fifty years. Every great artistic work has been original. It also has had its prototypes, even as Fra Angelico had his Masaccio and Masaccio his Giotto; Michael Angelo had his Donatello and Donatello his Phidias; Le Pautre had his Marot and Marot his Berain; Robert and James Adam their classical inspirations; the Gothic cathedrals their Roman prototypes. Each successful architectural wave as it came on was preceded by another before it of which it formed a part, giving again of its substance to the one succeeding it.

One of these waves appears to be indicated in such a building as the new Hotel Shelton. This hotel, shouldering its central mass by lesser ones, thus meeting with the recent New York requirements, seems to supply the most refreshing details and composition. But the Hotel Shelton is no more New Yorkesque than it is Californiaesque—no more than Cass Gilbert's depot for the United States Government is Chicagoesque. Such freshness of design as this Hotel Shelton displays is the result of former examples of good national American architecture. It reflects our endeavor to do simply, humbly, with care and study the work which we have before us—work without ostentation, architectural bigotry, or personal trade-marks.

But I have digressed from the by-paths of Fifth Avenue. Significant among your greatest landmarks is that choice example of Hunt's, the old Vanderbilt mansion at 52d Street. It is true that the French of François Premier, of the château styles with their Gothic inspiration creeping into modern civilization and the Renaissance movement, interests us little to-day; nevertheless can we pass this fine work of Hunt's without endeavoring our best to keep it

safe in our memory? Here in a great, modern, prosaic American street we have one of the finest of the French inspired examples of American residence architecture. Let us not criticise it as it passes from us. Let us rather read its sentiment of classic French refinement and culture, touched maybe by Molière and Corneille, peopled by men and women of bygone times with deep-colored satin doublets and silken dresses. It is true that we are accustomed to the more gray simplicities of the American modern gentleman, reflected better by the Guggenheim residence or the Knickerbocker Club—but beware lest we too fall into a dream bigotry and be awakened by the oncoming rush of these powdered and gayly colored damsels who crowd our streets, donning the rouge and affectations of two hundred years ago. Our austere Puritan character may suddenly change its clothes and put this quaint, affected, and imaginative Vanderbilt mansion quite in place again.

Whither goes our American architecture in reviewing your Fifth Avenue? We architects can surely emulate its greater examples by doing our best, most sincere work—not by copying—not by scientific inventions—but by humbly working out our individual problems constantly inspired by good examples—such as we find in the best work of Fifth Avenue.

Marble, Mosaic, and Terrazzo

By David B. Emerson

OF the many materials which enter into modern building construction, hardly one has been used more continuously than marble, which is, undoubtedly, the most beautiful of all building-stones. Its use goes back into antiquity so far that no one can tell when it commenced. Herodotus wrote that the great pyramid of Ghizeh was cased with polished marble. The Greeks made most extensive use of it, both in building and for sculptural purposes. Rome was practically rebuilt of marble under the Emperor Augustus, whose boast was that "he found his capital of brick but left it of marble." So from the earliest days down to the present, with but little intermission, marble has been used as a structural and a decorative stone.

The purpose of this article is not, however, to deal with the history of the use of marble, nor of the methods of the ancients, but to discuss modern means and methods as they concern the United States at this present time.

Marble may be broadly defined as a crystalline limestone, composed chiefly of carbonate of lime, carbonic acid, and water, but included with the true marbles are serpentines, porphyry, travertines, and alabaster, all of which possess one element in common, which is that they are susceptible to a high polish. The supply of marble in this country is practically inexhaustible, the entire Appalachian range, from Vermont to Alabama, being rich in marble deposits; in fact, a very fair quality of marble has been quarried in the city limits of New York City within the past twenty-five years. In addition to these Eastern deposits, very good marbles are quarried in Missouri, Utah, Colorado, Texas, and California.

American marbles have a very fair range of color and considerable variegation, but for brilliant coloring and beautiful veining we are almost entirely dependent upon the foreign marbles. the principal sources of supply being Italy, France, Belgium, Greece, North Africa, and one of the finest of the serpentines comes from Ireland.

The use of marble for architectural purposes may be divided into two general classes: structural (which can be classed as including all exterior work with the possible exception of panels or tablets, which are set into the walls on the outside of buildings) and decorative (which will include all interior work except floors, stair-treads, lavatory partitions, etc.)

In the selection of marble for structural purposes, the first considerations next to the beauty of surface are soundness and weathering qualities. The best class of marbles for this work are what are known as "saccharoidal" marbles, that is, those having an even grain, and which present a sugary appearance on fracture. In this class of marbles are included the Vermont White, Stockbridge, South Dover, Tuckahoe, Georgia, and many of the best-known white marbles of America as well as the famous Carrara marbles of Italy. Pink Tennessee marble, which is also a sound marble, but not saccharoidal, has been used to a moderate extent as a structural marble with excellent results. Most of the highly colored variegated marbles are entirely unfit for structural use, as the coloring and veining, being largely caused by the presence of metallic oxide and other impurities, weaken the marble and frequently render it subject to disintegration, due to atmospheric impurities and the action of sun, rain, and frost.

When marble is used structurally, the same general conditions which govern the use of granite and limestone are observed. No stone thinner than four inches should be used. All ashlar should be anchored back to the brick backing, always using copper or brass anchors. Marble should always be laid in mortar composed of non-staining cement properly tempered with well-seasoned lime putty, and the backs of all stones should be plastered with this mortar to prevent staining. The exposed faces of structural marble are usually given a sand-rubbed finish, and portions of the work are sometimes polished. The writer remembers one house which was built in New York City some years ago the entire front of which was polished.

Marble as a decorative material has many and varied uses. The practice of veneering surfaces with marble slabs is claimed to have originated with the Romans, who made most extensive use of that form of decoration, which is one of the most common methods of using marble at the present time. In decorative marble work the questions of soundness and durability of the marble to be used become minor considerations; therefore, the architect may use all of the colored and variegated marbles, and be very well assured that they will stand, and also that the color and texture of the surfaces will not change with time. Marble for interior work, except where large mouldings, columns, or other large sections are required, is sawn in slabs seven-eighths of an inch, one and one-quarter inch, one and one-half inch, one and three-quarter inch, and two inches thick, as long and as wide as the rough blocks, which average about five feet by ten feet, and with some marbles as long as fourteen feet.

In selecting marble for floor-tile, stair-treads, and door-saddles, only hard, sound marbles should be used, as is also true of lavatory partitions, etc. Some of the marbles which may be used for this class of work are pink Tennessee, gray

Tennessee, Tennessee cedar, white Italian, most of the black marbles, either domestic or Belgian, Connemara green, and some of the American serpentines, all of which are sufficiently hard to withstand the wear which floors and stairs receive. Marble for interior work is usually finished by polishing all vertical surfaces, with the exception of those portions which are carved, and hone-finishing or sand-rubbing all floor-tile, stair-treads, and door-saddles. The polished surfaces may be either highly polished or given a very slight gloss, as may be desired. Vertical surfaces may be hone-finished if desired, but this finish is very seldom satisfactory except with unicolored marbles, as polishing brings out the color and veining in variegated and brecciated marbles.

The greatest care should be exercised in the setting of interior marble work, as, no matter how beautiful the marble may be, it will never show to the best advantage if poorly set. It can be said with safety that "a well-set job of cheap marble looks better than a poorly set job of expensive marble." Interior marble work should always be set in plaster of Paris, using casting plaster. All slabs, mouldings, etc., should be anchored back to the walls by means of copper or brass wire anchors. Anchors should be made of No. 8 Brown & Sharpe's gauge copper, or brass wire, for seven-eighths-inch stock, and heavier for thicker stock. Anchoring should always be done on the edges of the slab when possible, and anchors should be well wedged in the wall and into the slab, and set in plaster of Paris. Door and window trim, where the edges are exposed and polished, should have V-shaped anchors drilled into the back of the marble. All columns should be secured with copper dowels from one-quarter inch to one-half inch in diameter, according to the size of the column.

The work of setting marble should always be started at the floor level, and the base, or first course, should be set before the finished floor is laid. Slab work should be set out from the walls at least three-quarters of an inch, so that any dampness which may be in the walls will not penetrate the marble, and the cement in the walls cannot stain it. The edges of all slabs at the top, bottom, and sides should be rubbed straight and true, with sharp arrises, so that the joints shall be neat and close. Marble floors should be laid on setting beds two inches thick, of one to three cement mortar laid on top of the concrete floor-slabs, or on concrete foundations, if the building is of wood-joist construction. The setting bed should be carefully spread and levelled off to a true plane to receive the floor-tile. The borders should first be laid and properly levelled up, then the main body of the floor should be laid, levelling with the borders, and, if the surface is large, spotting tile at intervals, carefully levelling them up, and then working to them. The joints in floors should be as close and tight as is possible, and after laying should be grouted with non-staining cement mortar.

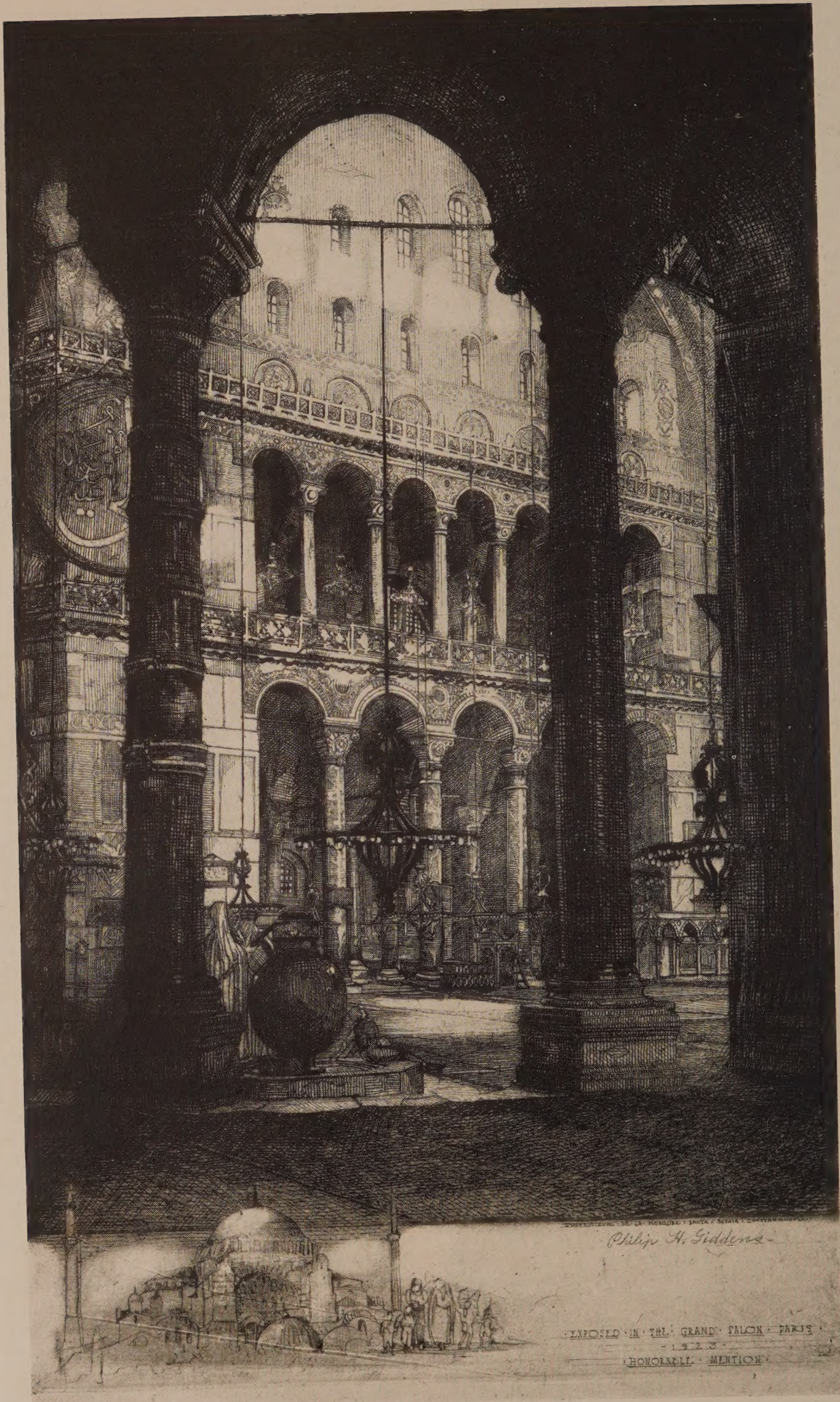
Marble mosaic makes a very excellent and not very expensive floor for public and semipublic buildings. Mosaic pavements have been in use so long that no one knows their origin, nor when or where they were first used. There have been many types of mosaic in the past, and the early mosaic-workers were true artists, as well as clever craftsmen, but the modern mosaic-worker is, at the best, merely an artisan, and his work is, therefore, merely mechanical. Modern mosaic floors are made up of small cuboids of marble, called tessare. These are set in a setting bed of cement mortar, which should be tempered with a small quantity of lime putty or hydrated lime. This setting bed should be at least one inch thick, and should be reinforced with a galvanized wire mesh to prevent the cracking of the mosaic, due to settlements in the floors. Borders and designs which are to be laid in the body of the floor, are laid face downward and glued to drawings made on heavy paper, then reversed and laid in the setting bed. Floors should be well grouted with cement mortar and ground down to a level surface by means of electrically driven carborundum wheels. The best white tessare are imported from the Carrara district in Italy, although the American saccharoidal marbles may be used quite as well.

For borders, designs, inserts, etc., any of the sound colored marbles, such as Belgian or American black, serpentines, Belgian rouge, etc., may be used, but the softer marbles, such as Numidian, Siena, Breche Violette, etc., should be avoided, as they wear easily and are liable to disintegrate. Terrazzo, or more correctly Terrazzo Venizio, makes an excellent floor, and is considerably cheaper than marble mosaic. It is composed of marble chips mixed with Portland cement. These chips, which are called "Granito" by the marble trade, are graded as No. 1, No. 2, and No. 3, running from one-quarter of an inch for No. 1 to three-quarters of an inch for No. 3.

The usual method of laying terrazzo floors is to lay a setting bed not less than one inch thick of cement mortar, the same as for mosaic floors, except that it should contain no lime, over which the terrazzo matrix, five-eighths of an inch thick, should be laid. This matrix may be composed of one-third of a ton of Granito, one-half No. 1 and one-half No. 2, and four bags of Portland cement, which will cover one hundred square feet. The marble chips and cement should be mixed together dry and turned over several times, so that the materials will be thoroughly mixed together. The mixture should be thoroughly wet, then spread on the floor and brought to a straight level surface. As soon as this is done, the surface should be sprinkled with No. 3 chips, which, if the best finish is desired, should be Carrara chips, using one hundred and fifty pounds of chips to one hundred square feet of floor surface. After sprinkling the surface with the chips, the floor should be well rolled with heavy rollers, which should be kept wet, so they will not pick up particles of the aggregate, thereby spoiling the texture of the surface. The more rolling the terrazzo is given the better, as it compacts the material and brings the marble to the surface. After rolling it should be well trowelled to close all pores. After the terrazzo has set for forty-eight hours, it may be polished. Polishing should be done with carborundum wheels. A good terrazzo floor should show eighty-five per cent or more of marble on the finished surface.

The use of different colored marbles in varying quantities makes it possible to obtain striking color combinations in terrazzo. As the greatest fault with terrazzo is cracking, expansion joints should be put in the floors at regular intervals. The best form of expansion joints are corrugated strips of either brass or zinc, which are set in the setting bed before the matrix is spread. An excellent way to prevent cracking of terrazzo is to set marble strips in the floor, dividing it into squares of from ten to twelve feet. This adds very little to the cost of the floor and is almost a positive assurance against cracking.

To obtain the best results in the use of marble, particularly for fine interior work, it should be specified very carefully and explicitly, something which many architects neglect to do, leaving all questions as to quality, finishing, and setting to the marble-worker, who, in the majority of cases, be it said to the credit of the trade, rises to the occasion and saves the day.



SANTA SOPHIA, CONSTANTINOPLE

From the Etching by Philip H. Giddens, Fellow of the American Field Service for French Universities
Received Honorable Mention in the Paris Salon of 1923

ARCHITECTVRE*
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THE PROFESSIONAL ARCHITECTVRAL MONTHLY
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Editorial and Other Comment

Art vs. Expediency

IT is all very well for us to read our old books about the men who built in Greece, in Italy, the men who gave us the great Gothic churches of France and England, and to talk about art in the abstract as if we still believed in it. But things are on the go in these days, and there is mighty little time, less patience, to bother with the mere talk of art in building.

At least this is the idea we gather from hearsay comments on much of our new business architecture. We are so much in a hurry, so crowded for space, that we haven't any time to waste in a futile hunt for the thing called art or beauty or what you will.

Professor William A. Boring, of the Columbia University School of Architecture, said recently:

"A conflict 'almost revolutionary' is going on between 'power' and labor.

"The buildings of to-day are the silent historians of this struggle. Characteristic American architecture is being modified with consequent loss of beauty, though evidences of an American style are, however, beginning to appear.

"While it is recognized that a nation's history is truly reflected in the architecture it produces, we are hardly prepared to see this national expression follow the political and economic changes so promptly as is now so evident throughout the land. The triumph of organized labor is a phenomenon which will be recorded permanently in the building of to-day.

"No longer do we see heaps of stone quarry blocks surrounding the site of a growing building and hear the pleasant chatter of the stone-cutters' chisels giving architectural form to the stones. To-day huge motor trucks bring all material ready to set in place, and their burdens are lifted by powerful derricks and deposited on the scaffold. The hissing of hoisting engine and steam excavator and the aggressive tattoo of the power riveter proclaim that a building is being born into the world.

"This state of things develops naturally in the struggle between power, on the one hand, to push forward, and of labor, on the other, to hold back. It is of great import—almost revolutionary, in fact.

"The architecture of to-day is making a record of these conditions in the form, style, and fabric of the buildings we erect. The practising architects mould their design primarily to accommodate the needs of occupation, and then try to wrest, from an unwilling labor system, buildings which have some semblance of beauty."

This is the mood of the day, not only in our architecture but in everything that concerns us.

We are becoming human machines, and our ability to keep our wheels going, to step on the gas, to run true to form without any old fashioned and obsolete notions that we are not entitled to the whole road, is the measure of the thing dubbed success.

But some of us retain a lingering, sneaking liking for the old ways, and we venture the bold statement that there are still many practising the profession of architecture whose souls are harrowed by the ever-present demand of business compromises, who would if they were permitted think quite as much of beauty as of utility in the things they are called upon to design.

Quantity production, speed, economic necessity are paramount in an age of such tremendous vitality and competition.

The thing that surprises us is not the lack of beauty, however, but the evidences of its existence, in many of our hurriedly built and gigantic commercial structures.

The will to put it over seems to live, even if it is bad form to talk about it among practical and serious-minded men.

Are We Overdoing It?

THERE are indications that the recent new renting season has brought to our attention, that the speculative building of apartments has about reached its peak, and that many of them may remain more or less idle for some time.

Last year it was the exception to find "to rent" signs anywhere in our cities; the demand was far greater than the supply, and this in spite of greatly increased prices for even the very modest apartment. A casual survey of building in New York City indicates that there are more vacancies than for several years. Building has progressed in spite of the high cost of both materials and labor, until there seems a surplus of places where people may live if they can stand the rentals demanded. Many of these high-cost small apartments are to let at prices nearly four times their normal rent a few years ago.

Even with the tremendous influx of new population and the ever-shifting character of people who live in city apartments, there is evidently room enough if people can afford to pay the large prices asked. But we are inclined to think that the limit of thousands of home seekers has been passed, and that the builders will soon be made to realize this fact. The new apartments have set a pace for the old ones, and rents have been boosted wherever possible to the last limit of tolerance.

There doesn't seem to be any immediate solution of the problem of living for most of us as long as real estate is held by the few and these few determined to make all the hay in sight. It is the old law of supply and demand, and apparently up to the present there are always those who can afford to pay whatever is asked. That there is room and plenty of it for apartments built on a co-operative ownership plan is being proved constantly, and we wonder why more of our shrewd and farseeing investors are not in line to reap the safe and continuous income that developments of this kind are sure to yield.

The family that owns its apartment has established a home, and the home owners are the sort of folks that stay put and make up our most substantial citizens. There is

no reason any more, apparently, why the enterprising local architect should not combine the offices of architect and promoter, by pointing the way to the man with money to invest in real estate the profitable way to go into this field of endeavor.

Looking Around

IN other pages of this number we print, with all due modesty, a letter addressed to the editor by William Jones Smith, of the well-known firm of Childs & Smith, architects, Chicago, in which he comments on the result of a recent walk up Fifth Avenue and a look along adjacent streets.

After ten years he came back to see some of the old things with a fresh eye, and to get from them, not something new, perhaps, in the way of suggestion, but to realize that, after all is said, there are a lot of old things that retain the fine lesson of sound training and good design.

Mr. Smith was greatly impressed by the skill with which our men have adjusted themselves to the new zoning laws, and if in the beginning some of the buildings were not all that we could wish, certainly the recent high buildings showing set-backs are marvels of clever and suitable meeting of difficult restrictions.

American architects have always risen to the occasion, and never more convincingly than in recent years of large commercial construction. Without precedents to follow they have made a really new American architecture in this new field of zoning. The result has been a good thing for our congested cities and a good thing for the men who have been called upon to create a new type of high building and to solve difficult problems in design.

Modern Buildings in South America

THERE is nothing that gives a better indication of the rapid progress being made in South America than the large amount of building in its cities. In places where two and three story adobe structures have been typical for centuries, these new buildings, many of which would do credit to any American or European city, give the best possible proof of the confidence of the native population and of foreign investors in the future of South America. That many of these new buildings are occupied by the representatives of foreign firms is an interesting indication of the important rôle that foreign capital is playing in the development of the resources of South America.

A good example of the type of building that is taking the place of the poor structures in many of the South American cities is a new office-building just completed in Lima, Peru, at a cost of about a million dollars by Mr. August N. Wiese, one of the proprietors of the importing firm of Emilio F. Wagner & Co., the representatives of the Westinghouse Electric International Company in Peru. When the building is completed its main floor and basement will be occupied by the Emilio F. Wagner Company.

The structure is five stories high and occupies a ground area of about 16,000 square feet. The construction is of reinforced concrete throughout with finish and trimmings of granite and marble. The first floor and basement are entirely separated from the upper floors and have a separate doorway. A large rear entrance is provided for receiving and dispatching shipments of stock and machinery, and the main doorway on the front corner of the building admits the public directly into the large display room and offices of Wagner & Co. The rear entrance is equipped with a ne of five-ton capacity for unloading heavy apparatus from trucks in the street and shifting it to an hydraulic elevator. A third entrance, with two electric elevators, is provided for the upper floors.

The basement will be used as a storeroom by Wagner & Co. and will also contain a large vault made of 3½-inch steel walls covered with concrete. A concrete-lined water-well about 120 feet deep will make available an abundance of pure water for use in the building. An 80 H. P. Diesel engine will provide power for the pumps and elevators and for electric generators, which, in time of emergency, will supply the building with its own electric light. An independent telephone exchange will be maintained. Typical of the modern construction are the floors of the building, which are of painted asbestos, noiseless, sanitary, and fire-resisting.

Japan Admits Building Materials Free

BUILDING materials and the necessities of life have been exempted from import duty until March 31, 1924, by virtue of an imperial ordinance promulgated in Japan, according to advices received from the Consulate General of Japan, New York City. and forwarded to the Department of Commerce. Under the same imperial ordinance the import duty on automobiles, other than motor-trucks, but including automobile parts and motive machinery, has been reduced by one-half for the same period.

Information concerning specific commodities affected by this decree will be furnished upon request by the Division of Foreign Tariff, Department of Commerce, Washington.

Seasonal Unemployment

COMPOSITE New York employs only 50 per cent of its available workmen during several months of the year. In March and April the New York that wants to build gets busy and then for six months, as now, has more work than men, and carries on in a frenzy of delays, high expenditure, and makeshifts. Last year the Committee on Seasonal Employment of the New York Building Congress recommended that in so far as possible building work be carried on during the dull periods of employment. This procedure would "reduce non-productive expense and waste, and increase production, as a result of having skilled help available instead of relying on incompetent workmen. It will eliminate excessive labor expense, lower the cost of materials, and decrease the contractor's margin of profits, as he prefers to keep his organization in employment as steadily as possible. The advantages are many and the benefits go to the community generally, being incidental in their value to labor, employer, and owner."

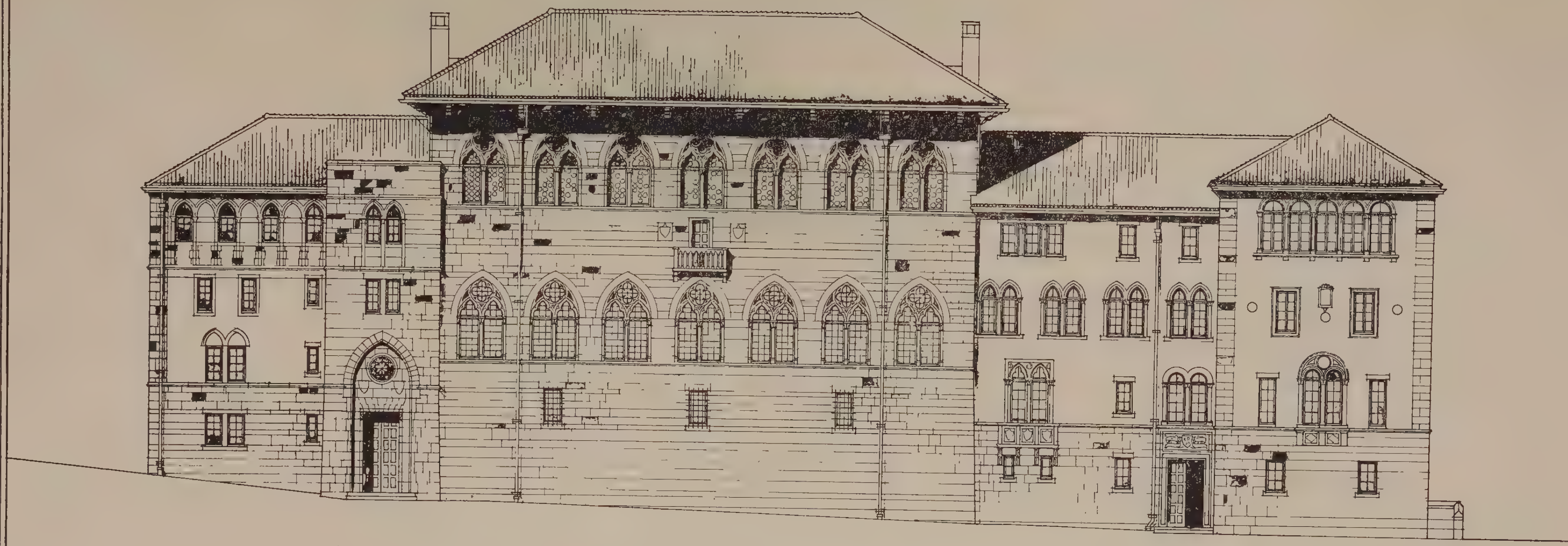
A further study of the records showed that building permits are issued in New York in the largest number during the spring and summer months, that contracts throughout the country are usually let at that time, and that repairs are made by landlords and owners during this time, when the demand on the industry is at its peak.

The situation can be largely bettered by changing these conditions and further by the completion of buildings in advance of rental dates, the rearrangement of present rental dates, the regulation of the time of carrying on government, State, city, religious, and educational building construction. In general, all work which can be removed from the period of peak load should be done during the months which have heretofore been periods of comparative unemployment.

From the report of the Committee of the Public Group of the Building Industry. R. H. Shreve, chairman.

SCHOOL OF ARCHITECTURE, PRINCETON UNIVERSITY.

Cram & Ferguson, Architects.



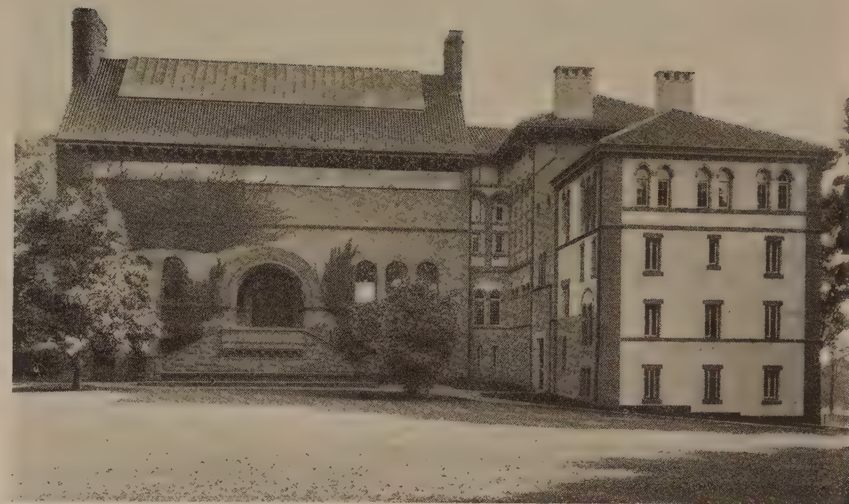
WEST ELEVATION

SCHOOL OF ARCHITECTURE
PRINCETON UNIVERSITY
CRAM & FERGUSON ARCHITECTS BOSTON

SYRIAN DOOR, ARCHITECTURAL MUSEUM (CASTS). Cram & Ferguson, Architects.

SCHOOL OF ARCHITECTURE, PRINCETON UNIVERSITY.

DETAIL, NORTH END OF NEW BUILDING. Cram & Ferguson, Architects.

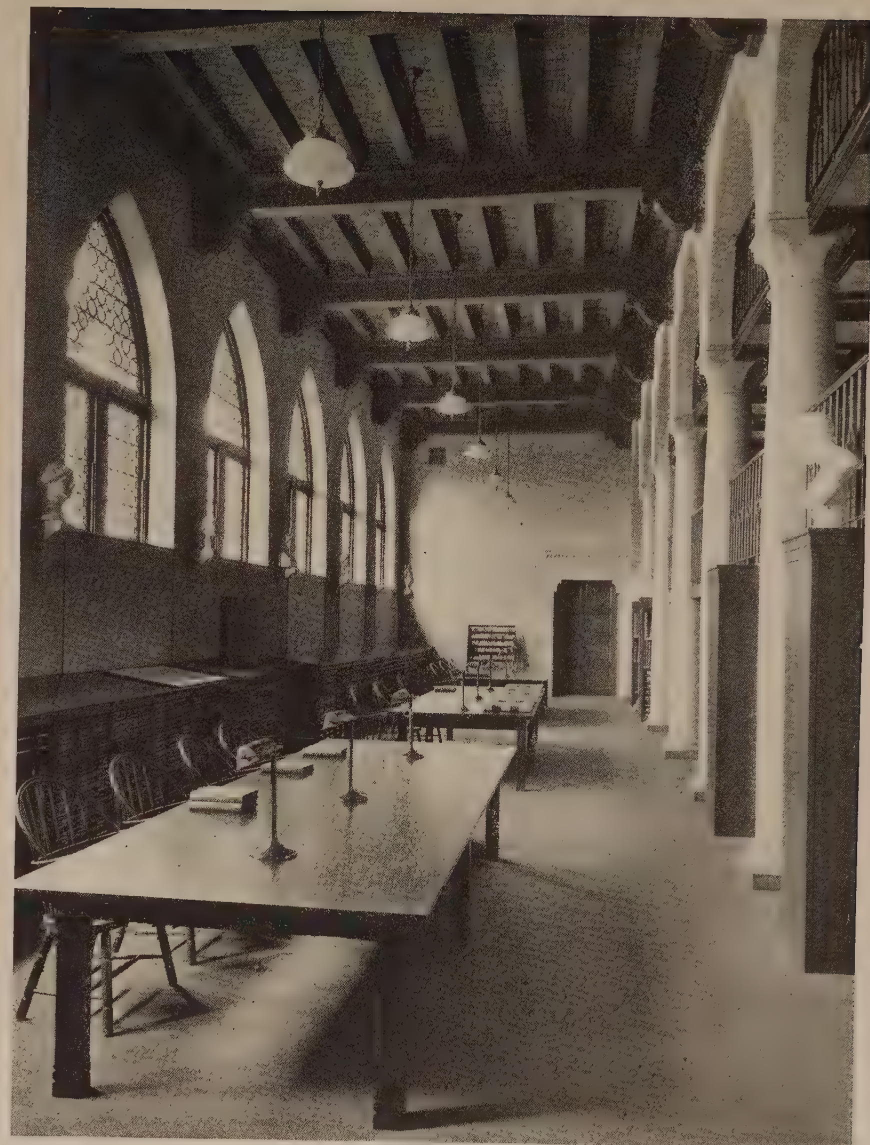


THE OLD BUILDING CONNECTED WITH THE NEW BUILDING.

PLANS OF NEW BUILDING.

SCHOOL OF ARCHITECTURE, PRINCETON UNIVERSITY.

DETAIL, SOUTH END.



LIBRARY.

Cram & Ferguson, Architects.

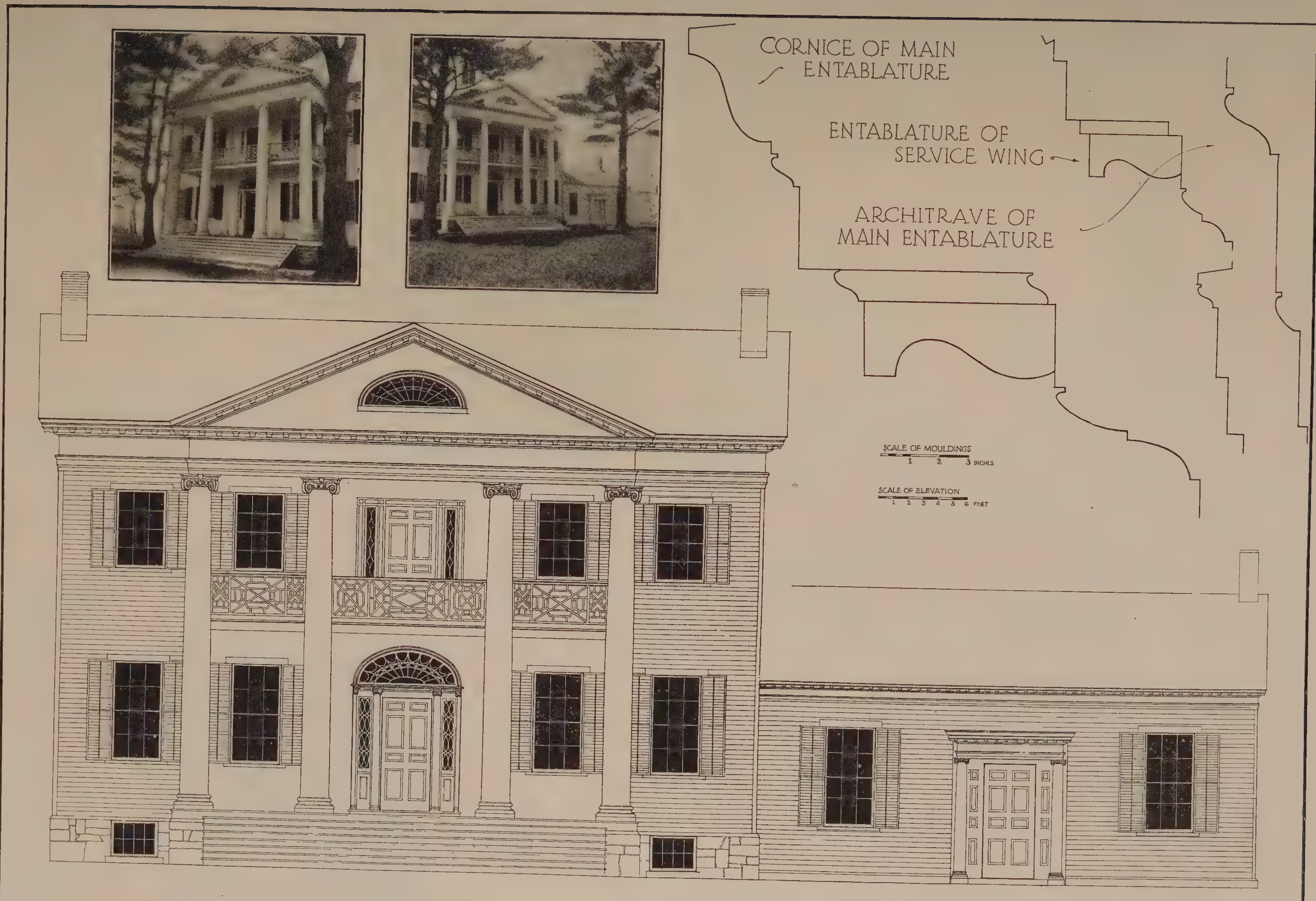
SCHOOL OF ARCHITECTURE, PRINCETON UNIVERSITY.

NORTH ENTRANCE VESTIBULE.

ARCHITECTURAL MUSEUM (CASTS).

Cram & Ferguson, Architects.

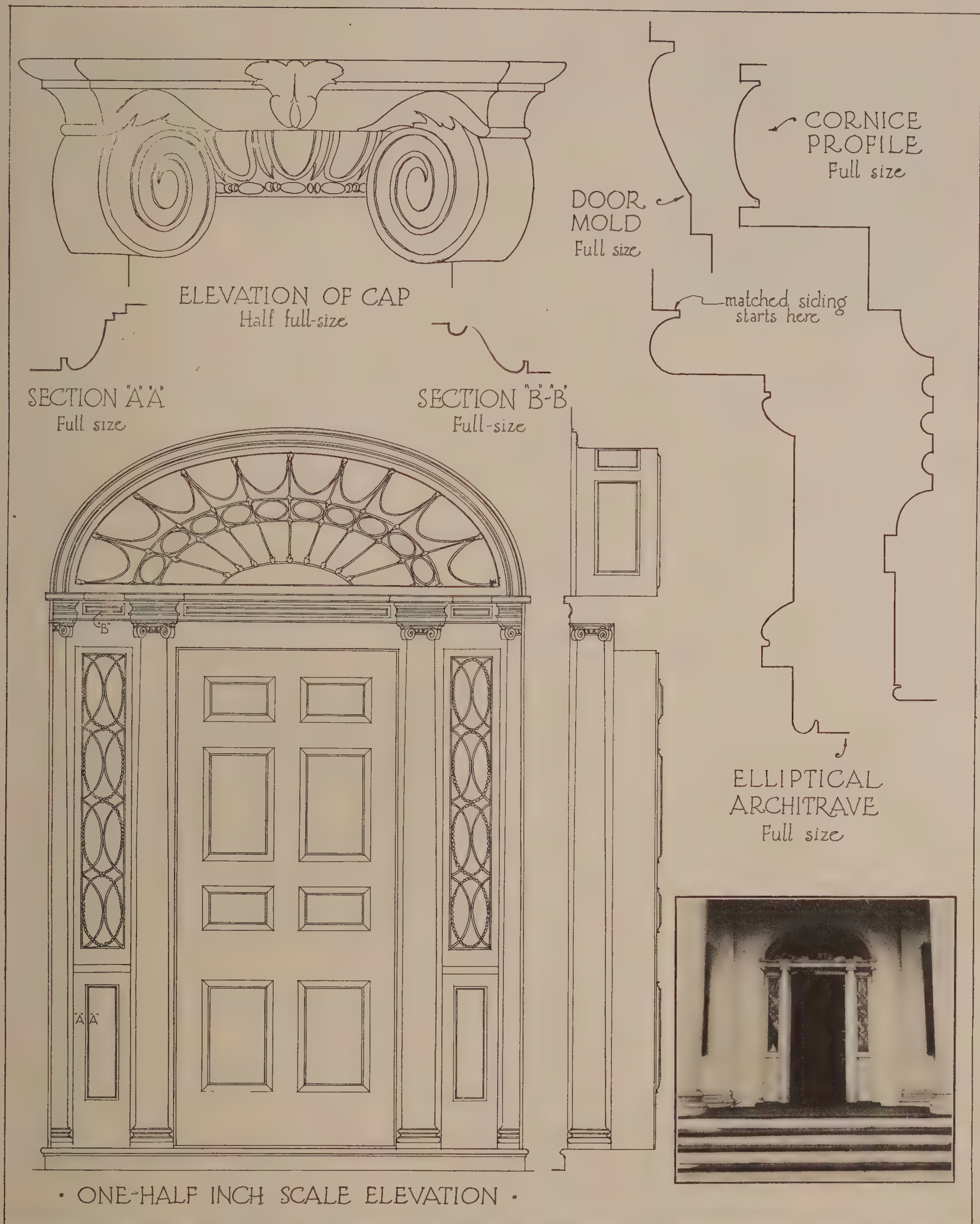
SCHOOL OF ARCHITECTURE, PRINCETON UNIVERSITY.



EARLY ARCHITECTURE OF CENTRAL NEW YORK

HOUSE AT CAYUTA LAKE NEAR ITHACA · N · Y ·

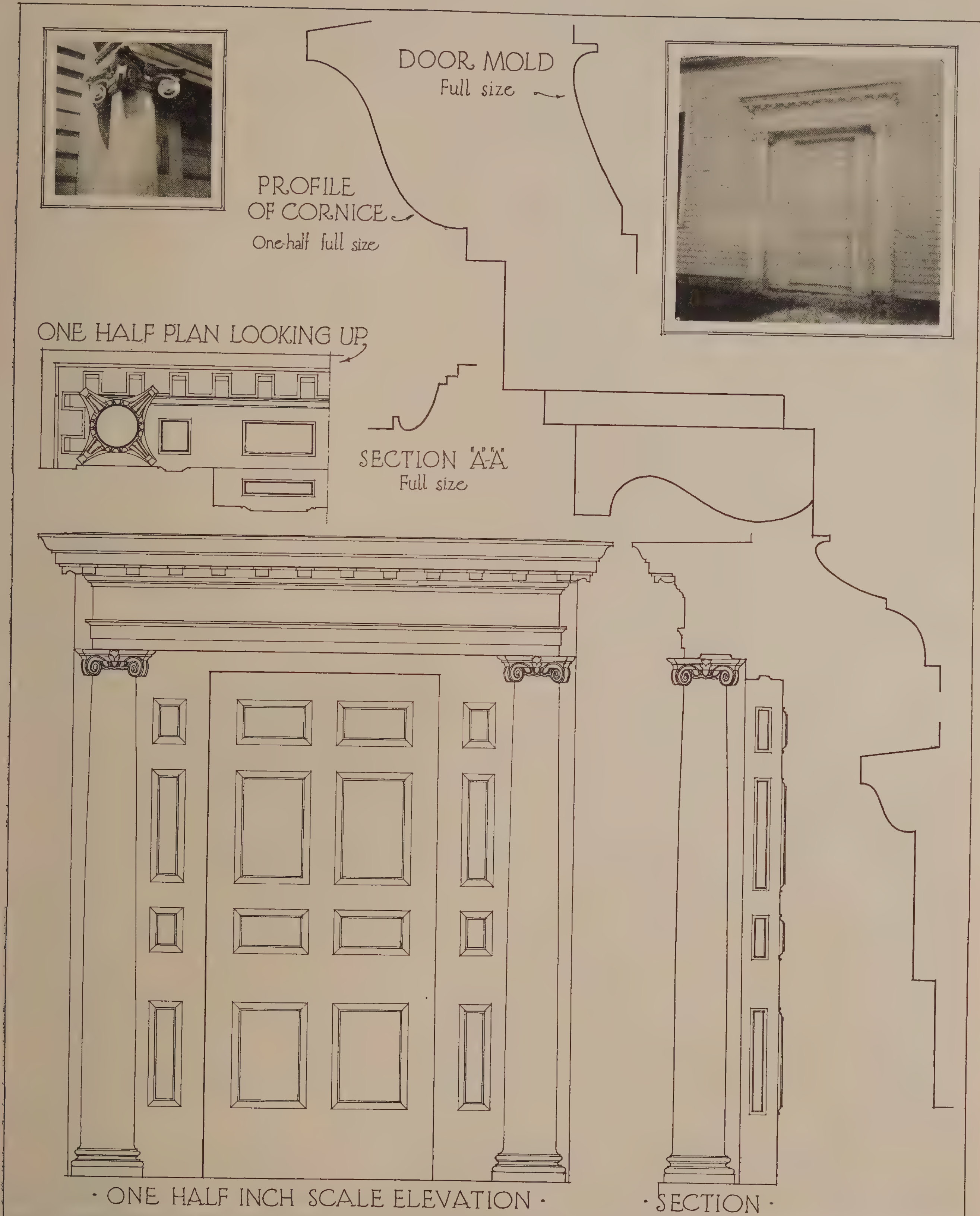
MEASURED & DRAWN BY CHARLES · M · STOTZ



EARLY ARCHITECTURE OF CENTRAL NEW YORK

MAIN ENTRANCE DETAILS
HOUSE AT CAYUTA LAKE N.Y.

MEASURED & DRAWN BY CHAS. M. STOTZ



EARLY ARCHITECTURE OF CENTRAL NEW YORK

SERVICE ENTRANCE DETAILS
HOUSE AT CAYUTA LAKE · N.Y.

MEASURED & DRAWN BY CHAS. M STOTZ

PLYMOUTH COUNTY TUBERCULOSIS HOSPITAL, SOUTH HANSON, MASS.

J. Williams Beal, Sons, Architects.

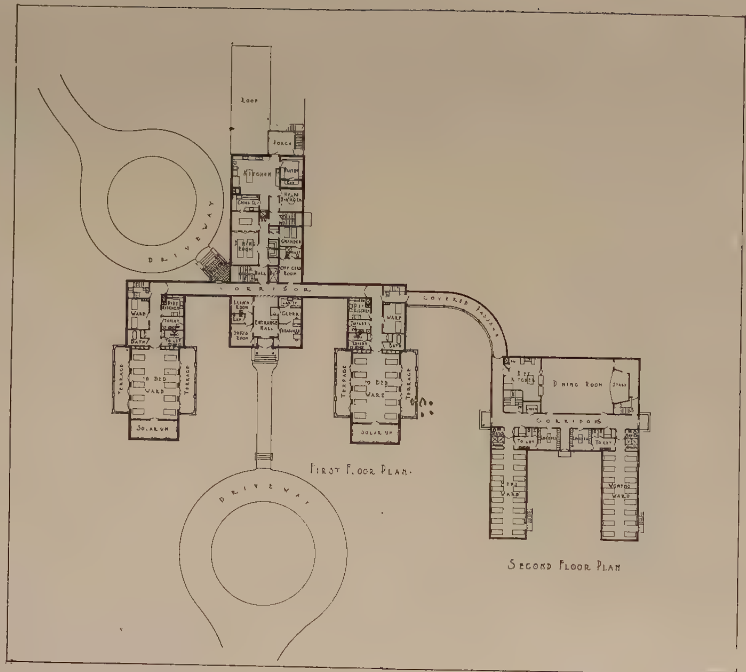
PAVILION CONNECTED BY COVERED PASSAGE.

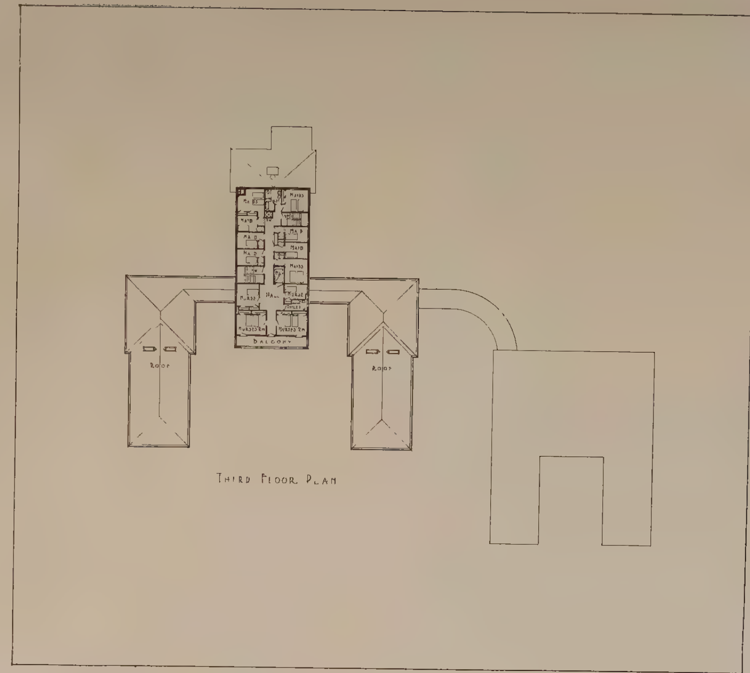
COVERED PASSAGE.

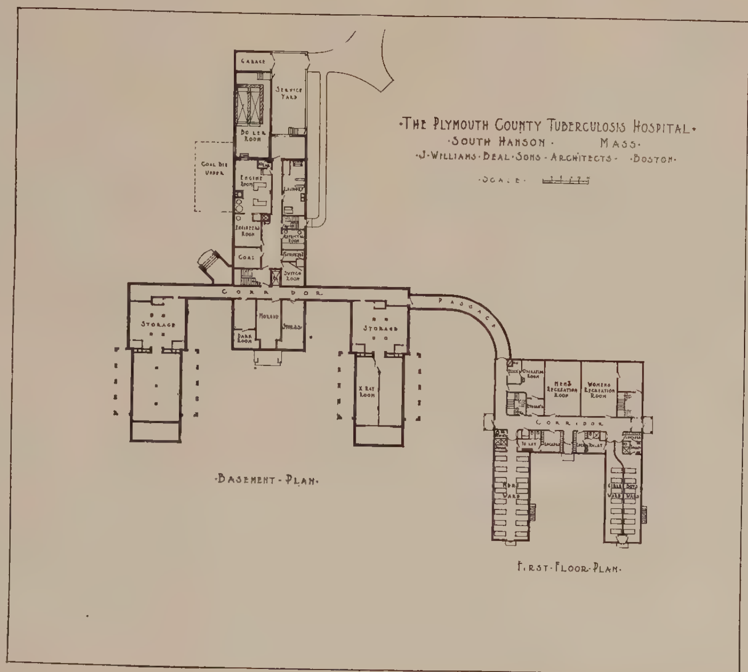
WARD.

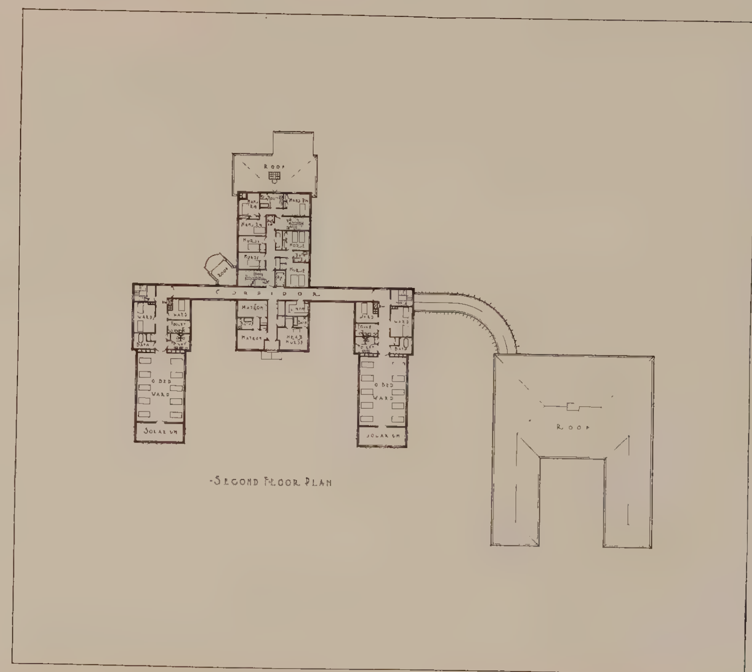
J. Williams Beal, Sons, Architects.

PLYMOUTH COUNTY TUBERCULOSIS HOSPITAL, SOUTH HANSON, MASS.









PLANS, PLYMOUTH COUNTY TUBERCULOSIS HOSPITAL, SOUTH HANSON, MASS.

J. Williams Beal, Sons, Architects

CORRIDOR STAIRWAY, STERLING CHEMISTRY LABORATORY, YALE UNIVERSITY. Delano & Aldrich, Architects.

LECTURE-ROOM.

LIBRARY.

Delano & Aldrich, Architects.

STERLING CHEMISTRY LABORATORY, YALE UNIVERSITY.

Detail.

Sterling Chemistry Laboratory, Yale University

Delano & Aldrich, Architects

THE new Sterling Chemistry Laboratory, at Yale, had its beginning in a combination of circumstances. The Chemistry Department was given practically an unlimited space on the new Hillhouse property, a piece of ground sloping gently from the north to the south. The chemists, who had all done service during the war, felt that the nearer approach could be had to army shacks, which could be easily put up and taken down, the more successful the building would be. The Sterling trustees, on the other hand, who were spending the money left by Mr. John W. Sterling, wanted something more monumental.

A plan agreeable to both was suggested by the architects, namely a "U"-shaped building, one story high for the most part, in which would be placed the research laboratories, classrooms, lecture-rooms, etc., leaving a large central court open to the north and covered by sawtooth roofs, which could be divided by partitions into almost any number of teaching laboratories.

Below, practically all of the central court is a low plenum chamber under pressure from a fan, supplying air at any point desired by simply puncturing the floor above. This chamber also serves as space for distributing and collecting all supply and waste pipes, making it possible to alter or repair the pipes without disturbing the rooms above.

At the intersection of the laboratory floor corridors is the supply-room. This room, directly connected with the

Corridor Recitation Floor.

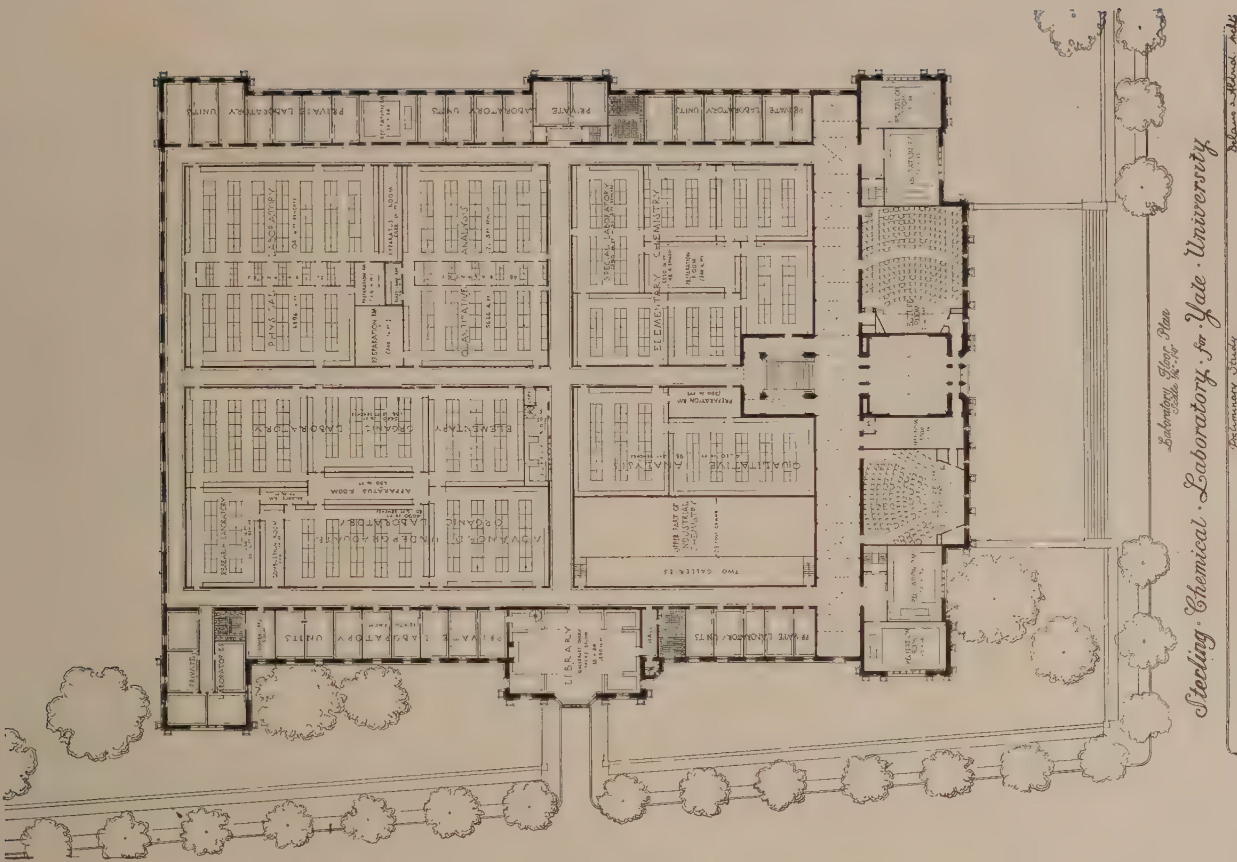
Roof Skylight Treatment.

Typical Laboratory.

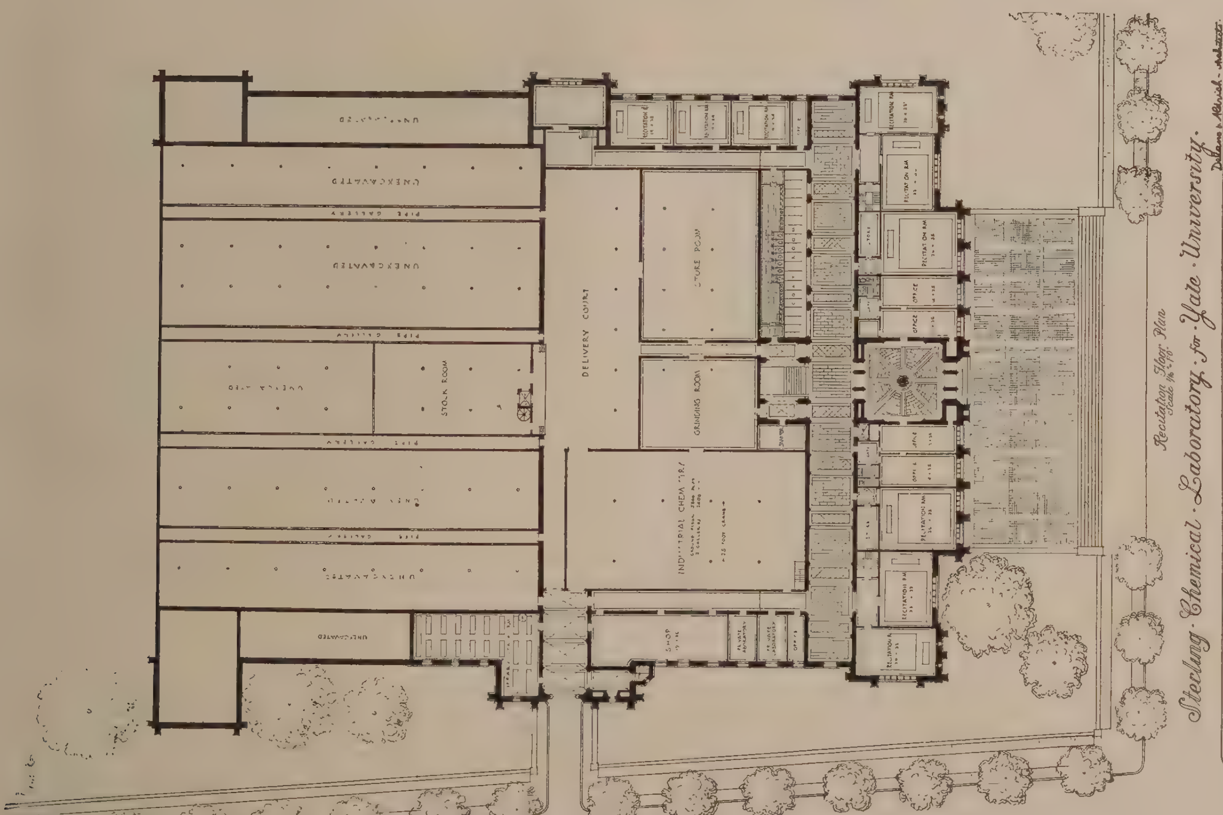
stock-rooms, and delivery-court below, is the one source of supplies for the entire laboratory floor.

As the plan developed advantage was taken of the slope to the south, so that at the southerly end the building is two stories high, and contains, in a separate unit, the class-rooms, lecture-rooms, and administration.

The Gothic type of architecture was imposed by the university authorities in order to harmonize with buildings already existing on the Hillhouse property, but the architects have succeeded in avoiding a very Gothic treatment and in giving the building the aspect of a working laboratory, which was what was desired. It is an entirely new departure in laboratory construction, and its flexibility and directness recommend it for the purpose for which it was designed.



Delano & Aldrich, Architects.



PLANS, STERLING CHEMISTRY LABORATORY, YALE UNIVERSITY.

Chicago Modifies Her Zoning Ordinance Regarding High Buildings

THE ban on high office-buildings in Chicago has been definitely lifted through action of Corporation Counsel Francis X. Busch, who ruled that under the new zoning ordinance the $15,000,000 thirty-two-story Straus Building, now being erected by S. W. Straus & Co., would not be violating the restrictions of the old building code, which prohibited a height greater than 400 feet.

And so the proposed height of 475 feet will be the actual height of the new structure, making the Straus Building not only the highest building on Michigan Avenue's developing sky line, but the first to come within the purview of the new zoning ordinance; the first to break through Chicago's building ceiling of 400 feet without a special ordinance passed by the City Council. Only one building up to this time has exceeded 400 feet in height, the Chicago Temple building, the imposing tower of which reaches 556 feet skyward. This height was made possible by a special ordinance granted by the City Council because of the inspirational nature of the tower feature.

Any possible question as to the meaning of the tower regulations of the new zoning ordinance in the light of the old building code is thus set aside through the action of the Corporation Counsel. The effect of the new zoning ordinance, adopted April 5, 1923, is that as far as the fifth volume zoning district, which includes all of the Loop area, is concerned the possible height of buildings has been increased.

Under the old building code the height of any building could not exceed 400 feet, which height included the height of a tower. The old building ruling was that the height of a building from the street to the top of the main section on which the tower would stand must not be more than 260 feet. Under the new zoning ordinance this figure was changed to 264.

Any divergence as to height between the old building code and the new zoning ordinance lies mainly in the restrictions placed on the tower development. Under the new ordinance the height of a tower is not specified, but is determined by the area of the lot and the cubical content of the building. This rule states that the cubical content of a tower may be one-sixth of the total cubical content of the building. According to the plans of the Straus Building the volume of the building as permitted by the zoning ordinance would be 7,452,776 cubic feet. Then the cubical content of the tower could be one-sixth of that figure, or 1,242,129 cubic feet.

The volume of the tower designed for and to be erected on the Straus Building will be 671,637 cubic feet, or 570,492 cubic feet short of the limit thus placed by the new zoning law.

The permitted area of the base of a tower on a Loop office-building is, under the new ordinance, 25 per cent of the total lot area. As the proposed area of the Straus tower is 4,863 square feet, the plans for the new building are well within the requirements of the city code, for, with a lot area of 160.70 x 171.80, or 27,608 square feet, the tower area could be one-fourth, or 6,902 square feet.

Under the old regulations the face of the tower could not be more than 25 per cent of the street frontage of the building. Under the new zoning ordinance the face of the tower may be 50 per cent of the street frontage of the building. The frontage of the Straus Building is 160.62 feet, and the tower frontage on Michigan Avenue is 80 feet.

These area and cubical regulations present more difficulty when the old height ruling of the former regulations is considered.

The 400-foot limitation, if attempt be made to apply it in conjunction with the 25-per-cent area limitation of the zoning law, would, at any rate in the case of the Straus Building, prevent the owners from realizing the full volume which the zoning ordinance permits. The 136 feet allowed for the tower under the old code, or 400 feet, the old building limit, minus 264 feet allowed under the zoning ordinance as the height of the main shaft, multiplied by the maximum permitted area of 6,902 square feet, gives a volume of only 938,672 cubic feet, while, as noted, the permitted volume under the new zoning law would be 1,242,129 cubic feet.

"The choice of the present plan, calling for a tower somewhat less in height than permitted by the new zoning ordinance," said S. J. T. Straus, senior vice-president of S. W. Straus & Co., "was made entirely upon the desire to effect the most beautiful and efficient building possible in the consideration of the size of the lot. Under the ruling of Corporation Counsel Busch the height of our tower could be 90 feet more than now planned, making the total possible height of the building 565 feet 3 inches, but because such a tower would be entirely out of harmony with the architectural spirit of the building, the design was chosen which would give the most beauty and, at the same time, the most efficiency throughout, both from the point of view of owner and tenant."

The building, if erected under the old code, would appear squat. If erected to the maximum height allowed under the new code the tower would be entirely out of harmony with the rest of the building. The decision was made in favor of the present tower plans, plans completely in harmony with the general architecture of the entire structure.

The choice between the 565-foot height allowed under the zoning code and the 475-foot height finally adopted was made principally on the basis of design. A large number of designs were submitted, contemplating a tower of full height, but in no case was it felt that the effect produced was a pleasing one, because the tower seemed to dominate the structure. S. W. Straus & Co. endeavored to avoid the impression of a tower building in the design of their structure, and finally selected a type of tower development that accentuates, rather than detracts from, the mass of the building. The higher towered structure would be a building plus a tower, while the design chosen gives a building with a central feature or tower, lending an impression of mass and dignity.

New Mining Experiment Station at Rutgers College, N. J.

THE Secretary of the Interior has designated Rutgers College, New Brunswick, N. J., as the location of a new mining experiment station of the Bureau of Mines, which will specialize in problems involved in the production and utilization of the non-metallic minerals. These minerals include bauxite, cement, clay, feldspar, fuller's earth, graphite, gypsum, lime, mica, phosphate rock, salt, sand and gravel, sand-lime brick, slate, stone, sulphur, mineral paints, garnet, asbestos, and talc. The value of these non-metallic minerals produced annually in the United States is in the neighborhood of a billion dollars.

The Quality of Material

By Richard P. Wallis

FIFTH ARTICLE

T. Lumber

THE factors bearing on the acceptability of timber for structural purposes are strength and length of life. The strength of a timber for structural purposes is determined by its weight or density, the size, quality, and distribution of knots, number of defects, and the percentage of moisture contained. The life of a timber depends upon the species and the care taken to protect it from weakening agencies such as weather, dry rot, etc.

The relationship of the strength properties of wood to its specific gravity is dealt with at length in Bulletin No. 676 of the United States Department of Agriculture.

I. *Laboratory Tests.*—The compressive and tensile strength of timbers intended for structural purposes is obtained by tests conducted by specially equipped laboratories with both sample cubes and full sized members.

II. *Field Tests:* (*a*) *Decay.*—A member may be tested for decay by striking it on one end with a hammer. If no concealed decay is present the sound of the blow will be clearly heard at the other end, whereas if decay is present there will be only a dull sound.

(*b*) *Moisture Content.*—The moisture content of timber may be determined with sufficient accuracy by cutting a number of small pieces $\frac{1}{4}$ inch in length with the grain, but not at the very end of the timber. These pieces should be carefully weighed as soon as cut and then placed in an oven heated to about the boiling point of water (212 degrees F.) for several hours. If pieces longer than $\frac{1}{4}$ inch are used the time of drying must be increased. The pieces are then taken out and weighed. The loss in weight represents the loss in moisture, which divided by the oven dry weight and multiplied by 100 gives the percentage moisture content in the lumber.

Thus if the lumber before drying weighed $125\frac{1}{2}$ ounces and after drying 110 ounces it would have lost $15\frac{1}{2}$ ounces. Dividing $15\frac{1}{2}$ by 110 and multiplying by 100 shows that the wood has slightly over 14 per cent of moisture. This is too great for wood destined to be used for interior purposes.

(*c*) *Odor.*—In order to detect the odors in woods, the sample should be whittled so that fresh surfaces are exposed, or, better, the sawdust should be used for this purpose.

(*d*) *Birch or Mahogany.*—In order to ascertain whether furniture is of mahogany or birch stained to represent mahogany it is only necessary to cut off a small portion of the surface in some inconspicuous location. If the article is of birch the cut will show white beneath the surface while in the case of mahogany the reddish brown of the natural wood will be exposed.

(*e*) *Hard and Soft Maple.*—Cut the sample across the grain. The hard maple offers considerable resistance while the soft maple cuts more easily.

III. *Inspection:* (*a*) *Grading Rules.*—Reference should be made to Circular No. 64 of the United States Department of Agriculture, entitled "How Lumber is Graded," for the various rules used by the lumber manufacturers in grading the quality of their product.

(*b*) *Defects.*—Knots occurring in members designated for compressive stresses only do not detract from the strength of the timber. They are however highly undesirable in the case of timbers subject to tensile stresses.

Loose or rotten knots and shakes may readily be detected by inspection.

(*c*) *Douglas Fir and Hemlock; Redwood, etc.*—Douglas fir, also known as red spruce, Oregon fir, and Oregon pine, can usually be distinguished by its distinct reddish hue, although the outer parts of old trees are often yellowish. It is a resinous wood, but on the average not as much so as the hard pines. Slight exudations of resin are often noticeable, especially on the ends, or can be made to appear by warming the wood. This test distinguishes Douglas fir from hemlock and redwood, with which it is often associated, but does not serve to distinguish it from the pines or larches, which, however are more of an orange brown to russet brown color.

(*d*) *Long Leaf and Short Leaf Pine.*—The accompanying diagram has been formulated by the Forest Products Laboratory as an aid in determining the species of pine.

Long leaf pine has a large pith, usually over 0.1 inch in diameter, while short leaf pine has a pith usually about the size of the lead in an ordinary lead pencil.

Occasionally a vigorous first year's growth may unduly increase the size of the short leaf and loblolly pines, in which case positive identification may be made by measurement of the pith diameter and comparing it with that of the second annual ring. These two diameters are platted on the accompanying diagram. If the point falls above the diagonal line the specimen is long leaf, if below it is short leaf, loblolly or some other of the minor Southern pines.

(*e*) *Southern Yellow Pine.*—The American Society for Testing Materials has adopted the following definition for Southern Yellow Pine:

Southern Yellow Pine.—This term includes the species of yellow pine growing in the Southern States from Virginia to Texas, that is, the pines hitherto known as long leaf pine (Pinus palustris), short leaf pine (Pinus echinata), loblolly pine (Pinus taeda), Cuban pine (Pinus heterophylla), and pond pine (Pinus serotina).

Under this heading two classes of timber are designated: (*A*) dense Southern yellow pine and (*B*) sound Southern yellow pine. It is understood that these two terms are descriptive of quality rather than of botanical species.

(a) Dense Southern Yellow Pine shall show on either end an average of at least six annual rings per inch and at least one-third summer wood, or else the greater number of the rings shall show at least one-third summer wood, all as measured over the third, fourth, and fifth inches of a radial line from the pith. Wide-ringed material excluded by this rule will be acceptable, provided that the amount of summer wood as above measured shall be at least one-half.

The contrast between summer wood and spring wood shall be sharp and the summer wood shall be dark in color, except in pieces having considerably above the minimum requirement for summer wood.

In cases where timbers do not contain the pith, and it is impossible to locate it with any degree of accuracy, the same inspection shall be made over 3 inches on an approximate radial line beginning at the edge nearest the pith in timbers

A. RING POROUS WOODS

WOOD	PORES	MEDULLARY RAYS	COLOR	TEXTURE
1. Ash (red, blue, gray, white, black, green, Oregon).	Minute in summer wood. Never radial, singly, or in groups.	Minute, barely discernible.	Grayish brown.	Heavy, strong, hard, quite tough, straight-grained, coarser than oak.
2. Osage orange (Bois d'Arc).	Minute in summer wood. Singly or in groups, never radially.	Minute, barely discernible.	Bright yellow or orange to brown.	Hard and strong.
3. Locust (black).	Minute in summer wood. Singly or in groups, never radially.	Fine but distinct.	H. brown. S. yellowish.	Heavy, strong, very hard, tough.
4. Locust (honey).	Minute in summer wood. Singly or in groups, never radially.	Fine but very conspicuous.	H. red. S. pale lemon.	Moderately strong.
5. Elm (rock, white, red, winged, cedar).	Annual ring contains one row of large pores. The smaller pores are numerous and are arranged in characteristic wavy bands in same direction as rings.	Indistinct.	H. light reddish brown, shades red and gray. S. grayish to reddish white.	Tough, hard, cross-grained.
6. Chestnut.	Very numerous in summer wood. Arranged in irregular radial rows.	Very minute, barely distinguishable.	Grayish brown.	Light, fairly soft, not strong, coarser than oak.
7. White oak.	Arranged in radial branching lines. Very fine and numerous and are crowded in outer part of summer wood.	Very distinct. Broad and conspicuous.	H. brown to reddish brown. S. white.	Very heavy, hard, stronger, tougher, less porous, and more durable than red oak.
8. Red oak.	Large pores in spring wood are more open, so that it appears more porous than white oak. Larger than in white oak, few in number, and mostly isolated.	Broad and conspicuous.	Slightly reddish.	More porous, less durable, and coarser than white oak.
9. Hickory.	Isolated and scattered. Those in summer wood but little smaller than those in spring wood.	Very fine, indistinct.	H. Red, brown. S. white.	Very heavy, hard, strong, and tough.

over 3 inches in thickness and on the second inch (on the piece) nearest to the pith in timbers 3 inches or less in thickness.

In dimension material containing the pith but not a 5-inch radial line, which is less than 2 x 8 inches in section or less than 8 inches in width, that does not show over 16 square inches on the cross-section, the inspection shall apply to the second inch from the pith. In larger material that does not show a 5-inch radial line the inspection shall apply to the three inches farthest from the pith.

The radial line chosen shall be representative. In case of disagreement between purchaser and seller the average summer wood and number of rings shall be the average of the two radial lines chosen.

(b) Sound Southern Pine shall include pieces of Southern pine without any ring or summer wood requirement.

(*f*) *Identification of Woods by Inspection.*—The variety of woods in common use is limited and it is a comparatively simple matter to identify the various species by means of their appearance and structure.

The presence or absence of pores, medullary rays, resin ducts and their arrangement, the color of the heart and sap wood, whether alike or distinct, and the texture all serve to help in the identification of any particular sample.

The accompanying chart represents an effort to present these various characteristics in tabular form as an aid in making these identifications.

The sample examined must be suitably prepared. It should consist of a smoothly cut end surface, preferably large enough to give some idea of the relation of the heart and sap wood. The cut should be made with a sharp knife or razor in order to avoid bruising the pores, as this greatly alters the structure of the wood and makes identification difficult. It may be necessary to use a small magnifying glass in making these studies.

It will be necessary to have a thorough understanding of the meaning of the terms employed in describing the structure and appearance of the several varieties of woods before it is possible to proceed with any degree of assurance.

1. *Classification.*—Woods used for structural purposes are divided into two more or less arbitrarily designated groups, namely Hard Woods and Soft Woods. The first group consists of the broad leaf or deciduous trees and the latter of the coniferous or evergreen species.

This designation is misleading as many of the so-called soft woods are harder than those classified as hard woods and vice versa, but these terms have become so fixed by usage that it seems hardly possible that this terminology will be changed.

The hard woods are subdivided into two groups according to the arrangement of their pores: Ring Porous and Diffuse Porous. The soft woods are all grouped under one head entitled Non-Porous.

2. *Pores.*—Before proceeding further it will be advisable to consider briefly the structural arrangement of woods in order to properly understand the following definitions. Wood differs from most other structural material in that it is composed of cells. These cells are minute, hollow, elongated tubes, grown tightly together and mostly closed at the ends.

In the hard woods certain of these cells are larger and form continuous passages. These cells are called pores and their presence distinguishes the hard woods from the soft woods.

The space between these pores is filled with wood fibres which are comparatively thick-walled cells of very small diameter. These are usually too minute to see except under the lens of a compound microscope.

In the classes of woods with which we have to deal the pores formed during the spring of the year are larger than those formed during the summer. This difference in size serves to differentiate the spring wood from the summer wood. The combination of the rings formed by one growth of spring and the succeeding summer wood constitutes what is known as an annual ring and is responsible for most of the patterns occurring in certain woods.

In the Ring Porous woods this difference in size of the pores is decidedly marked, which gives to the wood the

B. DIFFUSE POROUS WOODS

WOOD	PORES	MEDULLARY RAYS	COLOR	TEXTURE
1. Walnut (black).	Scattered through annual ring. Largest in spring wood. Visible to the eye.	Indistinct.	H. Chocolate brown. S. Whitish.	Heavy, hard, coarse.
2. Butternut (white walnut).	Plainly visible, vary from large to minute. Largest in spring wood.		H. Light reddish brown. Lighter than walnut.	Light, soft, weak, softer than walnut.
3. Mahogany (American, African).	Visible to unaided eye. (This distinguishes it from red gum.)		Reddish brown. Varies greatly in unstained woods from light to dark.	Rings are often irregular and are marked by narrow, light-colored lines in American species.
4. Cherry (wild, black).	Minute and indistinct. Most numerous in spring wood.	Very fine.	H. Vinous red. S. Yellowish white.	Heavy, hard, strong, fine-grained.
5. Birch (yellow, sweet, red cherry, canoe, white.	Uniformly distributed. Minute and indistinct.	Barely distinct without magnifying-glass.	H. light to moderately dark reddish brown. S. almost white.	Uniform, heavy, hard, strong.
6. Maple (hard, sugar, soft, silver).	Minute or indistinct. Evenly distributed.	Small to very small, but quite distinct.	H. Pale reddish brown. S. Creamy white.	Heavy, strong, stiff, fine texture, hard or soft as named, has thin reddish-brown layer at end of each annual ring.
7. Beech (ironwood, hornblend).	Minute or indistinct. Evenly distributed.	Large rays as wide as largest pores.	Reddish white to reddish.	Heavy, hard, coarse, stiff, strong.
8. Sycamore (buttonwood, buttonball, water beech).	Minute or indistinct. Evenly distributed.	Conspicuous (broad). More numerous and conspicuous than beech.	White to light brown.	Moderately heavy, hard, strong, cross-grained.
9. Red gum (sweet).	Evenly distributed. Invisible without lens.	No broad rays present. Small to very small, but quite distinct.	H. reddish brown. S. whitish.	Fine, soft, strong, uniform.
10. Yellow poplar (tulip, basswood, white wood, linden).	Evenly distributed. Minute or indistinct.	No broad rays present. Small to very small, but quite distinct.	White to light-greenish yellow. Satiny lustre.	Light, soft, not strong, uniform straight grain. Rings are lined by narrow whitish layer.
11. Basswood (limetree, American linden, bee-tree)	Exceedingly small.	No broad rays present. Small to very small, but quite distinct.	H. brownish white to very light brown. S. creamy white.	Soft, light, stiff, but not strong, without figure, fine texture.
12. Cotton gum (Tupelo).	Invisible to unaided eye.	Barely distinct without lens.	Grayish white or yellowish.	Heavy, strong, tough. Heart and sap wood alike. Rings indistinct.
13. Cottonwood (poplar, whitewood).	Minute, very numerous, and uniformly distributed. (Barely visible to naked eye.)	Indistinct even with lens.	White to pale gray. Often a greenish tinge in heartwood. Satiny lustre.	Light, soft, not strong. Uniform texture. Straight grain. Rings are limited by narrow whitish layer.

appearance of consisting of alternate concentric rings of large and small pores. These pores are numerous and are usually visible to the unaided eye on cross-sections.

The Diffuse Porous woods show numerous small pores usually not plainly visible on cross-sections without the use of a magnifying-glass. The annual rings are rendered distinct by a fine layer of denser summer-wood cells. The pores are scattered uniformly throughout the annual ring.

The Non-Porous woods show no pores even under the magnifying-glass. The annual rings are rendered distinct by the denser bands of summer wood. This summer wood is usually of a darker color than the spring wood.

3. *Texture.* The "grain" of the wood is governed by the relative size of the annual rings. Wood is said to be "coarse-grained" when the annual rings are wide and conspicuous and "fine-grained" when narrow and close together. "Straight-grained" refers to lumber in which the fibres run parallel to the surface and it is "cross-grained" when the fibres are not so parallel.

Texture also refers to the size and arrangement of pores or cell. A wood like oak or chestnut is said to have a "coarse texture," owing to the size and arrangement of its pores. Maple and cedar are said to have a "fine texture," owing to the comparative minuteness and distribution of cells. "Uneven texture" indicates a considerable difference in the hardness of spring and summer wood such as exists in yellow pine. "Even texture" indicates a wood in which there is but little difference between spring and summer wood in point of relative hardness.

4. *Hardness.*—Woods are classified with regard to their hardness as follows: very hard, hard, fairly hard, and soft. This classification is arrived at by measuring the impression or dent made by applying a known pressure to the wood.

A wood is said to be "very hard" when it requires a pressure of 3,000 pounds per square inch to make a dent one-twentieth (0.05 inch) of an inch deep. Maple, oak, elm, and hickory come under this classification.

A "hard wood" requires a pressure of 2,500 pounds to the square inch to make the same impression. Ash, cherry, birch, and walnut are all hard woods.

"Fairly hard" woods require 1,500 pounds per square inch to effect the same penetration and are represented by the better grades of pine and spruce.

C. NON-POROUS WOODS

WOOD	TEXTURE	COLOR	RESIN DUCTS
1. Fir (balsam, white, red, noble).	Light, soft, and weak. Coarser than spruce. No distinct heart wood.	Yellowish white. Summer-wood darker yellowish.	No ducts.
2. Hemlock (eastern, western).	Rough, brittle, usually cross-grained. No distinct heart wood.	Pale brown with reddish tinge.	No ducts.
3. Red cedar.	Fine texture, distinguished from redwood by characteristic odor. Soft to medium hard. Distinct heart wood.	H. purplish to brownish red.	No ducts.
4. Redwood.	Light and not very strong. Very durable. Pith rays very distinct. Heart wood distinct.	H. light cherry to mahogany, usually old rose S. light orange to dark amber.	No ducts.
5. White cedar (canoe).	Soft, light, weak, fine texture. Bitter tasting heart wood distinguishes it from cypress. Heart wood different only in shade from sap wood.	Pale grayish brown.	No ducts.
6. Cypress (gulf, bald, black).	Light, soft, and straight-grained. Irregular rings with narrow but dense summer wood. Greasy or waxy surface. Heart wood different only in shade from sap wood.	Dingy yellowish brown.	No ducts.
7. Spruce (white, red, black).	Light, soft, but fairly strong. Uniform texture.	H. reddish tinge. S. Almost white.	Very small and scarce.
8. Soft pine (white, sugar).	Very uniform, strong, light, easily worked. Rings show narrow inconspicuous bands of dense summer wood. Distinct heart wood.	Creamy white to light reddish brown.	Quite distinct, numerous, and scattered uniformly through rings.
9. Hard pine (long leaf, southern, short leaf, yellow, loblolly, Norway).	Medium hard and heavy. The rings are wider and show denser summer wood than in soft pine. Distinct heart wood.	Yellow or orange.	Quite distinct. More resinous than soft pine.
10. Douglas fir (red spruce, Oregon fir, Oregon pine, Douglas spruce, yellow fir, red fir).	Cross-grained and heavy. Distinct heart wood.	H. reddish orange. S. often yellowish.	Neither numerous nor evenly distributed. Not as resinous as hard pine.
11. Larch (western larch, eastern tamarack).	Hard and very strong. Western larch has narrow rings. Distinct heart wood.	H. light russet brown. S. yellow brown.	Inconspicuous and unevenly distributed. Distinguished from hemlock by indication of resin. Less resinous than the pines.

"Soft" woods require a much less application of pressure to effect a similar penetration. Hemlock, poplar, redwood, and butternut are classified as soft woods.

5. *Weight.*—The unit weight of a sample of wood is of great assistance in establishing the identity of that particular specimen.

Woods are usually classified according to their kiln dry weight as follows:

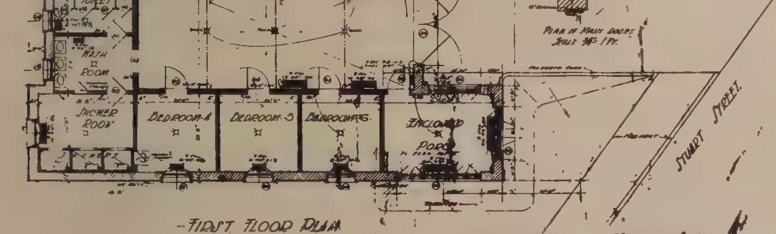
CLASSIFICATION	WOODS	WEIGHT PER CUBIC FOOT (IN POUNDS)	SPECIFIC WEIGHT (IN POUNDS)
Very light.	White pine, spruce, fir, white cedar, poplar.	less than 18–24	.30–.40
Light.	Norway and bull pine, red cedar, cypress, the heavier spruces and firs, redwood, basswood, chestnut, butternut, tulip, and heavier grades of poplar.	24–30	.40–.50
Medium.	Southern pine, pitch pine, tamarack, Douglas spruce, western hemlock, sweet gum, soft maple, sycamore, light grades of birch and cherry.	30–36	.50–.60
Heavy.	Ash, elm, cherry, birch, maple, beech, walnut, honey locust, best of southern pines, tamarack.	36–42	.60–.70
Very heavy.	Hickory, oak, osage orange, black locust, blue beech, best elms, ash.	42–48	.70–.80

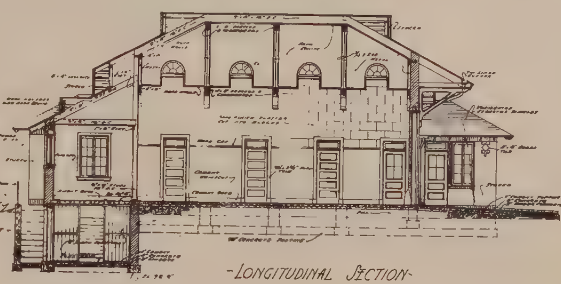
6. *Medullary Rays.*—Narrow strips of cells known as Medullary or Pith Rays extend radially from the centre of the tree to the bark. These strips of cells serve to conduct the sap to and from the bark. These rays are more distinct in some species of wood than in others, and are found principally in the hard woods.

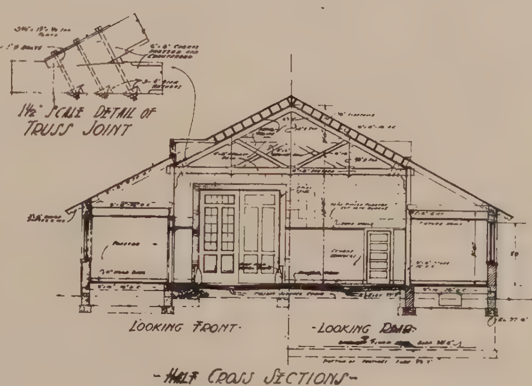
7. *Resin Ducts.*—Resin ducts are peculiar to certain of the soft woods and consist of small canals extending vertically and radially throughout the tracheids or small cells. In some woods these ducts are visible to the unaided eye but in others it becomes necessary to use a lens to distinguish them. The presence of resin ducts may be determined by trimming the end surface of a sample and placing it in a warm oven for from five to ten minutes. If the ducts are present resin will be exuded and will appear as specks on the end surfaces.

8. *Sap Wood and Heart Wood.*—The cross section of most species of timber shows a zone of wood next to the bark from one to three or more inches wide, of a light color and called the sap wood. This is the part of the wood that contains the life of the tree. The inner, darker part of the log is the heart wood.

This difference in color is not always pronounced and serves as one of the methods of identifying the various species of wood.







FIRE DEPARTMENT HEADQUARTERS, RICHMOND, VA. Carneal & Johnston, Architects.

Drafting-Room Mathematics

By DeWitt Clinton Pond, M.A.

THIRTEENTH ARTICLE

IN previous articles, when complicated processes of multiplication were encountered, it has been customary to resort to the use of logarithms, but there is a method used principally by engineers in solving such problems that is much more simple and accurate enough for most purposes. This method involves the use of the slide-rule, and most architects seem to think that this requires some special aptitude which only those with trained mathematical minds possess. This is really not the case, for the slide-rule is not a complicated affair, and it is only necessary to apply oneself to the practice of operation in the same manner that one practises the method of swinging a golf-club, or handling a billiard-cue, to become expert enough to do most of the problems which are presented to the draftsman.

There are certain kinds of slide-rules which have so many indications on them that only those engineers who are engaged in special types of design can understand the use of all of them. Such slide-rules are not to be recommended for the use of the architectural draftsman. The simpler the rule the better. Such a rule as he will probably find to practise on will have four scales, two on the stationary part and two on the slide. These scales are usually indicated as *A*, *B*, *C*, and *D*. *A* and *D* are stationary, and *B* and *C* are on the slide.

These letters are shown in the diagram in Fig. 49. It will be noticed that in this diagram only the *C* and *D* scales are indicated, and the reason for this is that these are the only scales which the beginner should attempt to use. There are two reasons for this. The reader will notice that the *A* and *B* scales are only one-half as long as the *C* and *D* scales, and for this reason the divisions are nearer and the chance of making errors is greater, and he will also see that in calculations which will be given later it is much more difficult to place the decimal point when the upper scales are used than when the lower ones are made use of.

It will also be noticed that there is a glass runner with a fine line engraved on its under side, which must be used as an indicator to establish the points at which the answer to the problem must be read or to indicate the various stages through which the problem is carried. If one becomes accustomed to the method of sliding the runner to the required position, and then the slide, then sliding the runner and again the slide—alternating in this manner throughout the problem—a large part of the difficulty of using the slide-rule will be overcome.

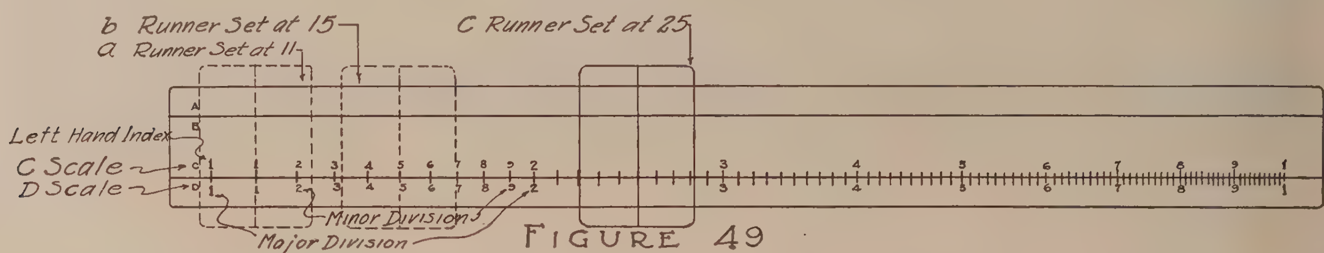


FIGURE 49

As an example of how this is done let it be assumed that the first problem is a very simple one, such as finding the product of 25 multiplied by 3.

One of the difficulties encountered by the beginner is that of understanding the indications on the slide rule. It will be seen that both the *C* and *D* scales are divided into nine major divisions. The first is between the large numbers 1 and 2, the second is between 2 and 3, and the last is between 9 and 1. These major divisions are always divided into ten minor divisions, and these are divided again into as many smaller divisions as possible. The major division between 1 and 2 is large and the minor divisions are indicated as 1, 2, 3, up to 9. If the runner is placed at the 1 of the minor division this represents 11 or 110 or 1100—any such number in which the first two figures are 1 and 1 and the rest are ciphers. This placing of the runner is indicated as at *a* in Fig. 49. If it is placed as indicated at *b* this will represent 15, 150, or 1500, and other numbers in which the first two figures are 1 and 5 and the rest are ciphers. If the reader will always consider the numbers in the problems as being read as he would read telephone numbers, this will simplify the reading of the graduations on the rule. Thus, if he is to multiply 25 by 3 he must consider the first number as being 2–5. Then he must slide the runner past the 2 of the major division and stop it over the line representing 5 in the minor division. This is shown at *c* in Fig. 49.

The reader, of course, should have a slide-rule on which he can practise, and should attempt to follow the steps outlined in this article. He should place the line on the runner over 11, 15, and 25 as referred to above.

With the runner at 25 (Fig. 49 *c*) the first step in the problem is taken. The next step is to place the 1—the first major figure on the slide—under the line on the runner. This is shown in Fig. 50. This figure 1, at the left hand end of the slide, will be referred to in the future explanations as the *left-hand index*. In the present case the left-hand index is under the line on the runner.

The next step is to slide the runner along until it is over 3 on the slide as shown in Fig. 50 *b*. Both the left-hand index and the figure 3 are on the *C* scale. On the *D* scale, under the line, will be found the answer to the problem, which should be read as a telephone number 7–5. It is advisable to note the steps taken in this example.

First on the *D* scale the number 25 is found and the

line is placed over it. Next, the left-hand index of the *C* scale is placed under the line. As the next step the runner is slid along the *C* scale until 3 is reached. Then the answer is found on the *D* scale.

The reader should practise this method as outlined above several times so that he will become accustomed to the method of reading the numbers on the scale, and of reading first on the *D* scale, then on the *C*, then on the *C* again and at last on the *D* scale. He should also become accustomed to the mechanical motions of sliding the runner and the slide. They should become automatic, in exactly the same manner as the motions of a person driving an automobile become automatic. At first they will require conscious thought, but by means of a little practice they will become almost instinctive.

The next problem will be the multiplication of 54 by 26, and the first step will be exactly like that of the problem given above. Reading the number 54 as 5–4, slide the runner past 5 of the major division (*D* scale) and stop it over the line representing 4 in the minor division. The next step is different from the one taken in the first problem, for it can be seen that should the left-hand index be placed under the line the slide will project so far to the right that the line which represents 26 will be off the rule. It will therefore be necessary to put the *right-hand* index under the line, as shown in Fig. 51. Next it is necessary to slide the runner to 2–6 on the *C* scale and then, under the line on the *D* scale, read the answer.

This, for the beginner, is not simple, for the answer contains four figures and the fourth must be estimated. It can be seen that the line is at the right of the 1 of the major division and 4 of the minor division, so it is known that the answer contains as the first two figures 1–4, and as the line is only a little to the right of 4 the last numbers must be estimated as naught-four, and the complete answer is one-four-naught-four.

As a check on the result given above it is always a good plan to multiply the numbers in a different order from that used at first. The runner is placed so that the line is over 2–6 on the *D* scale, the right-hand index is placed under the line, the runner is slid along to the left until the line is over 5–4 of the *C* scale, and then the answer is found on the *D* scale.

Now the question naturally arises as to whether the answer should be 1404 or 140.4 or 14.04. In other words, it is necessary to know where the decimal point is to be placed. In the first example it was a simple matter to judge how the answer—75—should be read as $25 \times 3 = 75$ and the answer could not be 750 or 7.50. But in the second example it is not so apparent.

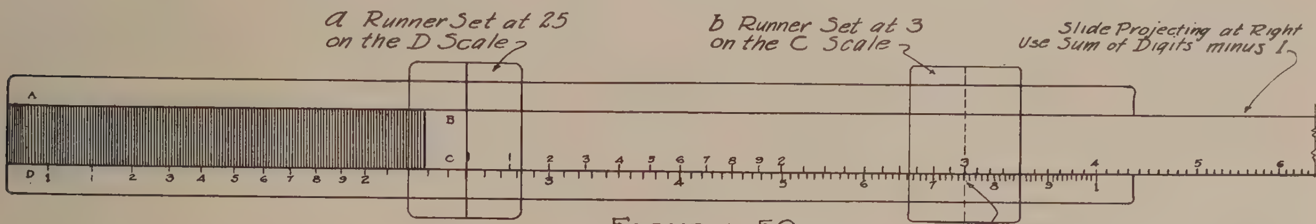


FIGURE 50

An easy method of finding how the decimal point should be placed is to multiply two numbers which are almost equal to those in the problem, but which are easily multiplied, and note the position of the decimal point. In this case the numbers assumed may be 50 and 26 and, as can be seen without even putting the numbers on paper, the answer will be 1300, and there will be four figures at the left of the decimal point. It is, therefore, logical to assume that there will be the same number of digits at the left of the decimal point, and the answer to the problem as 1404.

But this method is only approximately correct and there is one which, if followed with precision, will give the correct position of the decimal point. This method involves no complicated considerations—simply the need of watching the position of the slide. It will be seen that in the first calculation, in which 25 was multiplied by 3, the slide was at the right when the answer was obtained (Fig. 50). In the second problem the slide was at the left (Fig. 51). The positions of the slide have considerable significance. If the first problem is set down in the usual manner, $25 \times 3 = 75$, it can be seen that there are two digits in 25, only one in 3, and two again in 75, and the slide is at the right. If the numbers of digits are added the sum is 3, and when the slide is at the right the number in the answer is one less than the sum, or 2.

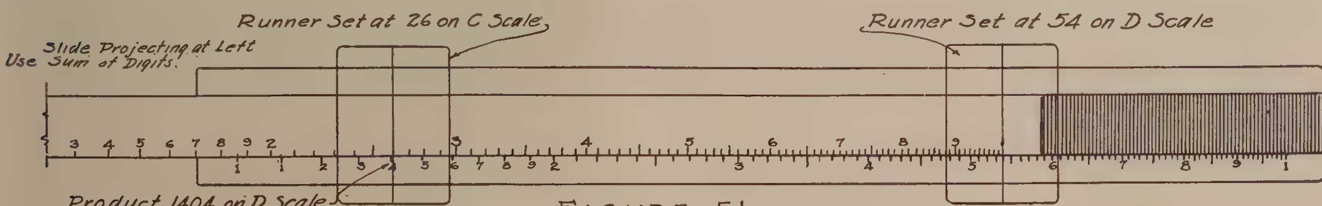


FIGURE 51

Try this again by multiplying 2 by 3. Here again the slide is at the right, the sum of the digits is 2, and the number of digits in the answer is 1, or one less than the sum of the digits.

In the second example, where 54 was multiplied by 26, it was seen that the slide was at the left, that the sum of the digits was 4 and that there were four digits in the answer. Therefore, it is safe to assume that if the slide is at the left the number of digits in the answer is given by simply adding the number of digits in the figures which are multiplied.

Try this by multiplying 2 by 6. The slide is at the left, the total number of digits is 2 and the answer contains two digits. The rule for multiplication is, therefore, that when the slide is at the right the product of the multiplication contains the number of digits found by adding the digits at the left of the equals sign and subtracting 1 from the sum. When the slide is at the left it is simply necessary to add the number of digits. These rules are simple enough but if the reader should forget them it is only necessary to multiply two simple numbers such as 2 and 3 and 2 and 7, and to check the results, to determine the rules for one's own use.

So far the problems have consisted of simply multiplying two numbers, but it is not at all difficult to multiply any number of figures; in fact, this is the real advantage of the slide rule. Two numbers can be multiplied as easily in the ordinary manner and as quickly as by a slide rule, but when one is confronted with many figures to multiply, as in determining cubic contents of buildings, then much time is saved.

The only difference between the method employed when three or more numbers are multiplied together, and the ones used above, is that the answer of the problem is not read until all the numbers have been multiplied. Suppose that the reader were confronted with the problem of determining the cubic contents of a building measuring 90 feet wide by 200 feet deep and 60 feet high. The figures given in this problem are chosen because they will not add much to the difficulty of solving the problem. Of course there are usually more complex dimensions encountered in the ordinary problems of the drafting-room, but the method is exactly the same.

First, the runner is set with the line over 9, then the right-hand index is placed under the line. Then the runner is placed so that the line is over 2 on the *C* scale. The next step is to place the right-hand index under the line again and to slide the runner to 6 and read the answer under the line on the *D* scale. This is found to be between the 1 of the major scale and the first 1 of the minor scale. Between these two figures there will be found 10 small divisions and so each division must count for 1. The line is over the short line between the eighth and ninth divisions. The answer can be read as one–aught–eight, but it is now necessary to determine how many ciphers to place after these figures.

In order to determine this it is necessary to recall that the slide projected to the left after each operation, and so it is only necessary to add all the digits in the numbers which were involved in the calculations. There were two in the first, three in the second, and two in the third, making a total of seven. Therefore there are seven figures in the answer, which is 1,080,000. The entire calculation can be stated as follows:

$$90 \times 200 \times 60 = 1,080,000$$

Of course it is almost as easy to do such calculations without the use of the slide rule as with it, but it is not often that dimensions are given in such round figures. Suppose that it is necessary to find the cubic contents of a pent-house measuring 13 feet 8 inches long by 12 feet wide by 14 feet 6 inches high. The problem can be written as shown below:

$$13.66 \times 12 \times 14.5 = ?$$

There are two new difficulties presented in such a problem. The first is that here are dimensions given in decimals of a foot, and the second is that the dimensions are such that the reader will have to exercise care in finding them on the scales. With regard to the first difficulty the numbers should be read as if there were no decimal points at all. The first expression should be read one-three-six-six, and if this can be found on the *D* scale the second difficulty will be overcome.

In Fig. 52 the slide is shown with the line over the position which represents 1366. The 1 of this figure is the number which indicates the first major division. The 3 is the number which marks the third minor division, and 6 is the sixth short line, which marks the smallest division. The last 6 must be estimated, and as each of the small divisions

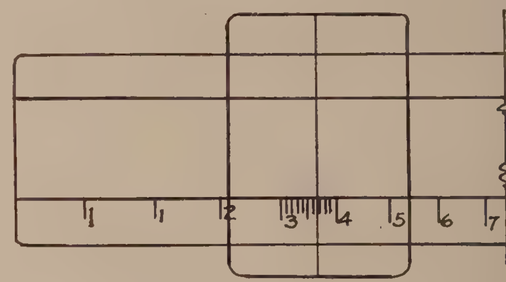


FIGURE 52

represents 1 then two-thirds of such a space will represent sixty-six one-hundredths.

With the runner over this figure, the left-hand index is brought under the line, the runner is pushed along until the line is over one-two of the *C* scale, and again the left-hand index is moved under the line. Then the runner is moved to the right until it is over one-four-five and the answer is found on the *D* scale to be two-three-seven-eight. The slide at the end of each operation was projecting at the right of the rule, and so the digits must be added in the following manner:

Only the digits at the left of the decimal point are counted, so in the first number there are two, in the second two, and in the third two. As the slide projected to the right in each case it will be necessary to add *one less* than the number of digits in each of the second and third numbers, so the addition is $2 + 1 + 1 = 4$. There are four numbers at the left of the decimal point, so the problem can be given as shown below:

$$13.66 \times 12 \times 14.5 = 2378$$

In the next article further problems will be discussed.

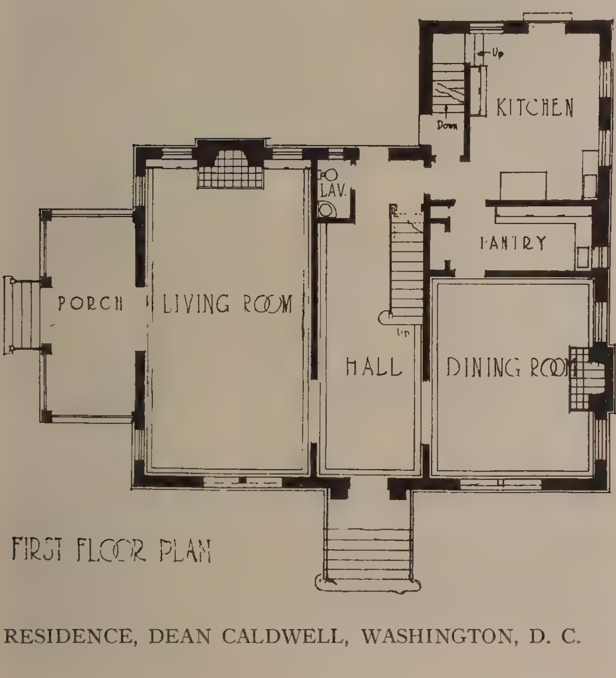
Announcements

We commend to our readers' attention an illustrated booklet on "Progressive Suggestions for Planning Church Buildings," published by the Home Missions Council, 156 Fifth Avenue, New York.

Brown & Von Beren, architects, New Haven, Conn., have published an architectural catalogue of their work, with numerous and admirably printed illustrations.

Clarence E. Shepard, architect, announces the removal of his office to Suite 412–415 Huntsinger Building, 114 West 10th Street, Kansas City, Mo.

Harvey R. Hoffmaster, architect, 3320 Lothrop Street, Detroit, Mich., desires samples, details, catalogues, etc., from the advertisers.



FIRST FLOOR PLAN

SECOND FLOOR PLAN

RESIDENCE, DEAN CALDWELL, WASHINGTON, D. C.

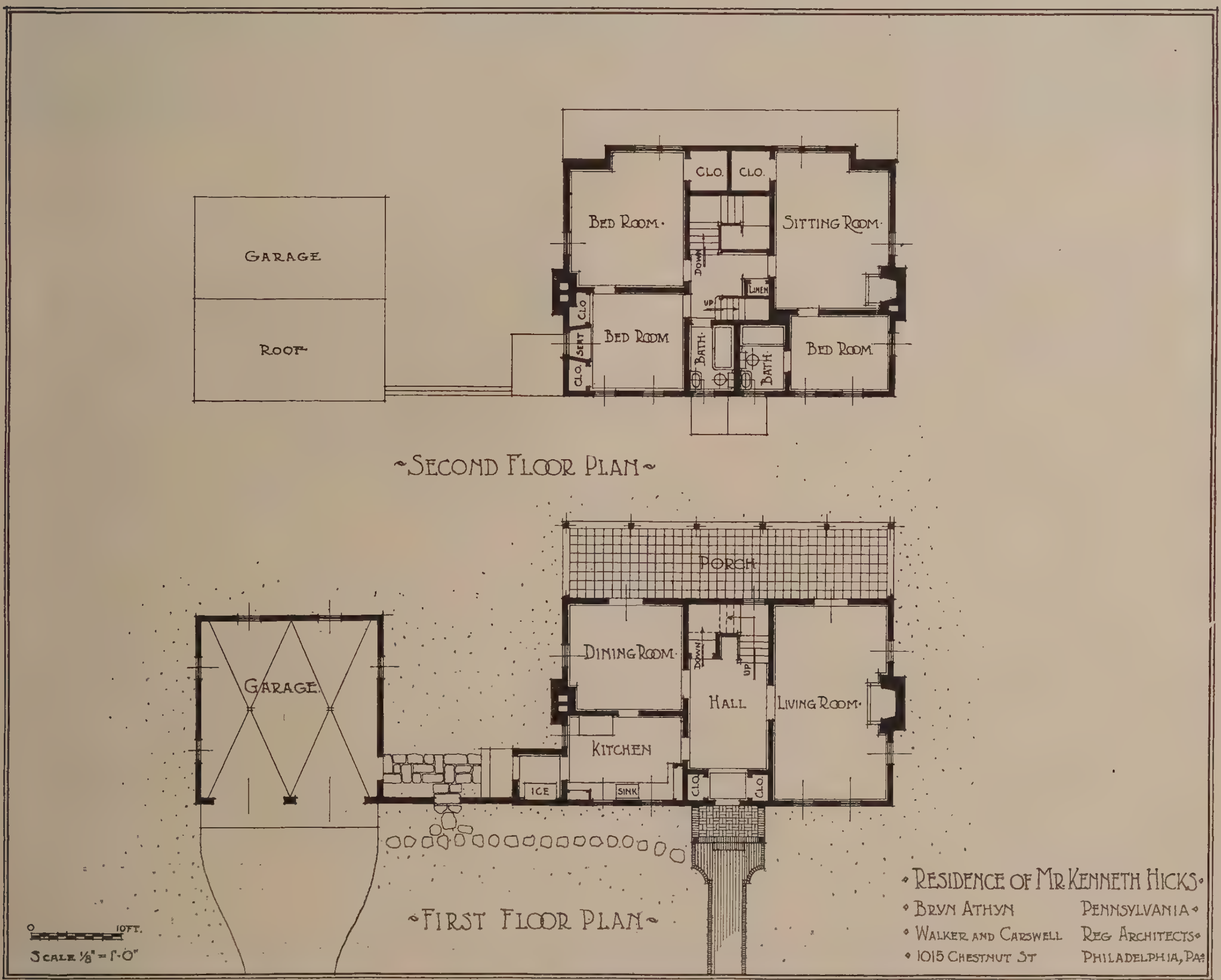
E. B. Morris, G. E. Buckingham, Architects.

LIVING-ROOM.

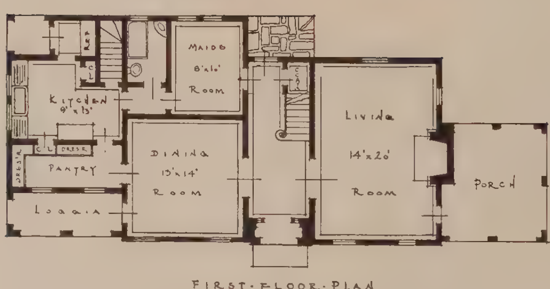
MAIN ENTRANCE.

HALL. E. B. Morris, G. E. Buckingham, Architects.

RESIDENCE, DEAN CALDWELL, WASHINGTON, D. C.



· RESIDENCE OF MR KENNETH HICKS ·
· BRYN ATHYN PENNSYLVANIA ·
· WALKER AND CARSWELL REG. ARCHITECTS ·
· 1015 CHESTNUT ST PHILADELPHIA, PA.



HOUSE, S. L. HUNNEWELL, WHITE PLAINS, N. Y.

W. Stanwood Phillips, Architect.

Book Reviews

66 ETCHINGS. Being Full-Page Reproductions of Etchings, Drypoints, Aquatints, and Mezzotints, and a Few Reproductions of Wood-Block Prints and Lithographs. By Members of the Print Society. Brought Together, Selected, and Edited by E. Hesketh Hubbard, R. O. I., A. R. W. A. (Founder of the Print Society). With an Introduction by Kinston Parkes (Author of "Sculpture of To-day," etc.). Published by The Print Society, an International Society of Print Makers and Collectors. Woodgreen Common, Breamore, in the County of Hampshire, England. The American Photograph Co., 428 Newberry Street, Boston, Mass., American Agents.

The real purpose of the Print Society is to help the good cause of creating a wider interest in prints and a better understanding of their charm and desirability as wall decorations. Not every one may own paintings, but good prints are within reach of even the modest purse, and good prints have the intrinsic value of individual artistic expression. An interest in prints is one of the most gratifying hobbies that the collector can cultivate. In this collection are included a wide variety of subjects and an illuminating and instructive showing of various technical methods. All the mediums employed have an especial appeal for the architect and draftsman.

MONUMENTS OF THE EARLY CHURCH. By Walter Lowrie, Late Fellow of the American School of Classical Studies of Rome. The Macmillan Company, New York.

In this volume the student will find a wealth of material, the result of careful research.

It deals with monumental remains of Christian antiquity and gives a detailed exposition of many of the most representative monuments, particularly of those shown in the many illustrations.

The author has avoided controversy and confined himself to well-founded and assured results of study in this field. The period covered extends from the second to the sixth century inclusive. Something of the book's value and interest may be obtained from the following chapter-heads:

Christian Cemeteries, General Description of the Catacombs, Christian Architecture, The Basilica, The Central Type, Furniture of the Church, Position and Surroundings.

Pictorial Art: Early Christian Paintings, Sculpture, Mosaics, Miniatures.

The Minor Arts, Glass, The Textile Art.

Civil and Ecclesiastical Dress.

Construction of the Apartment-House

By H. Vandervoort Walsh

Instructor of Construction, School of Architecture, Columbia University

ARTICLE X

THE FIREPROOF APARTMENT

THE modern fireproof apartment owes its existence to the change in the fashion of city living that gradually came about after 1873. Before this time, the well-to-do, educated minority did not approve of the tenement-house, but a few courageous builders convinced them that expert planning and good construction could make this way of living very comfortable. The "de luxe" apartment changed the old prejudice into a new fashion, and now this way of living in a city has become an established custom. Each year we find better and more luxurious apartments being erected which are planned by the finest architectural talent in the country and stand for the best in fireproof construction and equipment.

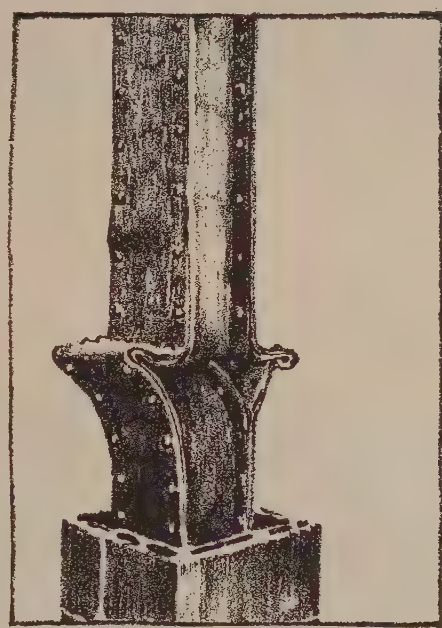
All of these apartments are equipped with elevators, and are usually ten to twelve stories high in New York City. This generally accepted height has come about by comparison of investment returns with construction costs and real estate values. Since they are more than five stories, they are required by law to be of fireproof construction. It would have been better if the building code had required even the five-story apartment to be fireproof, for then during the recent housing shortage the crop of cheap, five-story "walk-ups" would have been discouraged and never grown to menace the city and to be a real estate loss, since people will not, in the future, walk to the top floor if they can get quarters elsewhere.

No one to-day should think of a fireproof building in the literal sense of the name, for no building of this kind is proof against extreme fires. They are merely structures which are capable of resisting a hot fire for a few hours, and also confine any internal fire to its place of beginning. They can be roughly compared to a cast-iron stove that is lined with fire-clay tiles. We can have quite a hot fire in such a stove, and keep it there without much danger of setting fire to the surrounding floors, walls, or furniture. Similarly in a fireproof apartment, the curtains, hangings, furniture, clothes, and household articles in some apartment may catch fire and burn for quite a while without spreading to the next apartment or next floor.

In the meantime the fire department will be able to reach the building and check the flames at their source.

Any attack by fire, either from within or without, ought not to damage the building more than on the surface. If wood trim around doors and windows is used, it, of course, may be destroyed in a fire, and the plaster and floors may be ruined by water, but the structure itself should be thoroughly protected. That is, the steel frame must be entirely covered with fireproof materials.

As all fireproof apartments to-day are of the steel-cage type of building, this metal is the vulnerable part of the structure, for the columns not only support the floors and roofs, but also the exterior masonry walls. In fact, the structure is not much more than a steel frame, clothed with a skin of masonry, to protect it from corrosion and fire. It is not a question of whether or not the building is devoid of combustible materials, for steel is non-combustible, but it is a question of how well this steel is protected from excessive temperatures, should a fire occur, since steel expands considerably under heat. In fact, for every 100° F. increase in temperature a steel column 125 feet long expands an inch, which is quite enough movement to create a collapse in



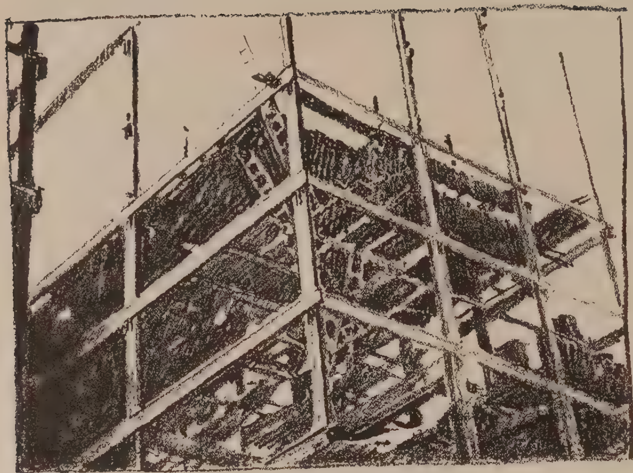
A FAILURE OF A COLUMN FROM FIRE

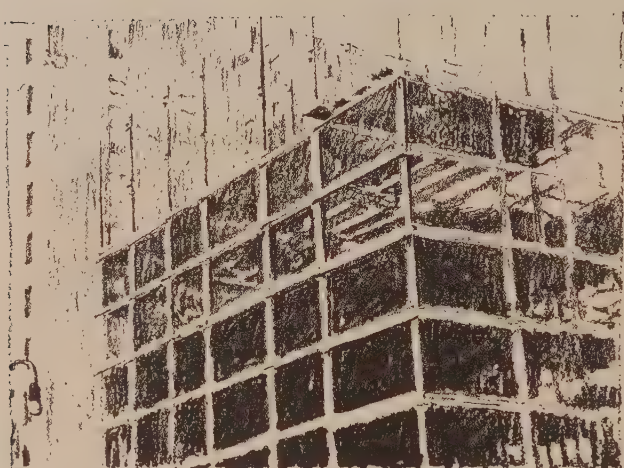
masonry walls that refuse to expand at the same rate. Then, too, an unprotected steel column will begin to collapse under its load at temperatures from 1,000° to 1,200° F. The buckling of a steel column, as shown in the drawing, is disastrous to the building.

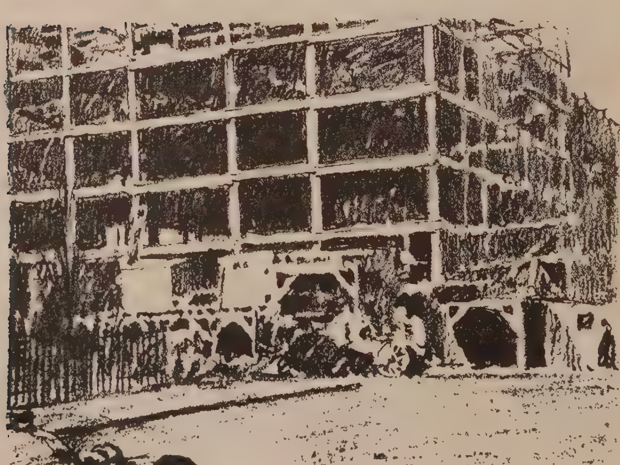
It is, therefore, necessary in the fireproof apartment to reduce all combustible material to a minimum and protect with fireproof materials all structural members of steel. The customary way of doing this, to-day, is somewhat as follows: The steel columns in the basement and their footings are covered with at least 3 inches of concrete. The columns in the exterior walls are protected by at least 4 inches of brickwork around them. Interior columns are surrounded by common brick set on edge, or by hollow terra-cotta tile 2 inches thick.

As these columns are located largely by the layout of the rooms, there are many irregular-sized bays. However, the steel I-beams which rest on the girders, spanning from column to column, are quite regularly spaced, about 8 feet on centres. It is essential that these structural I-beams, and also those used between exterior columns to hold up the masonry wall from floor to floor, be fireproofed. This is done by covering them with concrete at the same time

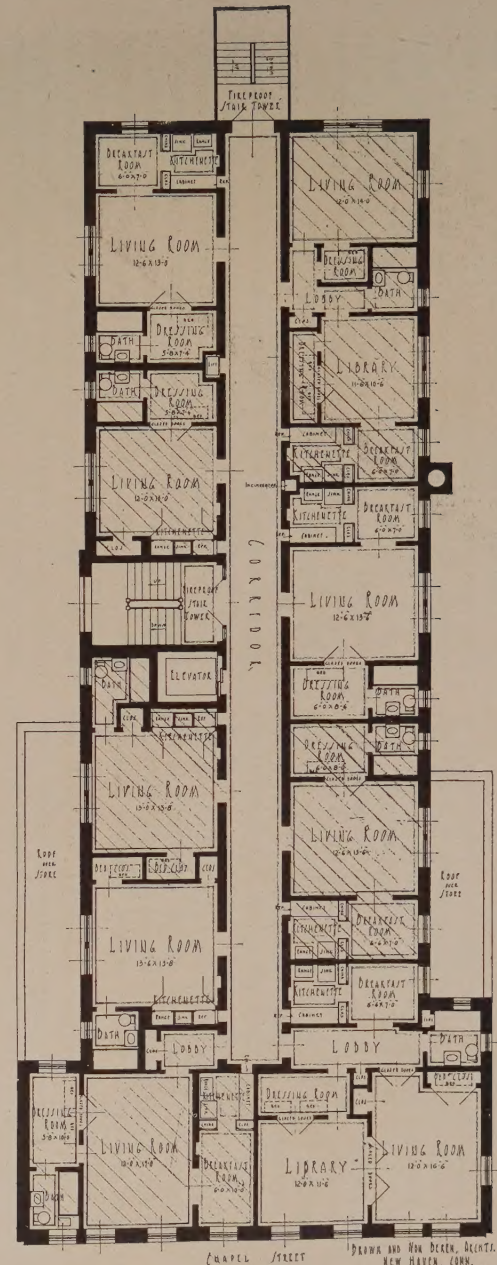
(*Continued on page* 396)







EL DORADO APARTMENTS, NEW HAVEN, CONN.



TYPICAL FLOOR PLAN

Brown & Von Beren, Architects.

The El Dorado is a six-story fireproof building comprising 48 complete apartments of four different types, each apartment having a private bath with tiled floors and wainscotings, built-in solid porcelain fixtures, tub and shower.

(*Continued from page* 393)

that the floor slabs are poured into the wooden forms. Arrangements for 2 inches of concrete to cover them are made when the forms are suspended for the floor construction.

Now we are quite aware that there are other types of fireproof floors than reinforced concrete slabs, but our observation of most of the new work convinces us that the reinforced slab is the one kind used for apartments. The type of reinforcement, too, is generally about the same, consisting of a network of wires, having the important reinforcing wires arranged parallel to each other about two inches apart, held together by smaller wires woven diagonally in both directions across the main wires, producing a pattern of triangles. This wire-mesh is laid over the top of the I-beams and allowed to sag to the lower part of the middle of the concrete slab. It may be spread over four or five beams. At the end slabs when it begins or ends, the wires are bent over the upper flanges of the I-beams, forming hooks to hold the mesh in place.

Exterior walls may be faced with brick, or brick and stone, but the interior is usually lined with hollow terra-cotta tile blocks. The blocks are 8 inches thick and the facing 4 inches. Around the steel columns in the wall, however, the brick work is carried and not the hollow tile. Over the interior of the hollow tile there is spread a coating of pitch.

As interior partitions are supported on the floor construction at each floor level, they are quite thin. Around stair-wells, elevator-shafts, and dumbwaiter shafts, 4-inch thick blocks of hollow terra-cotta tile are used. Other interior partitions are built of 3-inch thick hollow gypsum blocks.

Cinder concrete is spread over the top of the floor slabs, and in this are laid 2-inch by 3-inch sleepers, to which the rough flooring is nailed.

Wooden bucks, 3 inches by 4 inches in cross-section, are set up at door openings in interior partitions when wooden trim is used. In some apartments pressed steel door frames are preferred, and so the wooden buck is eliminated, the frame being set up and the partition blocks built up to the back of the frame.

Usually bathroom floors, public halls, and sometimes kitchens, are finished with tile. More often, the kitchen floors, pantry floors, and even the interior of closets are finished with a composition floor.

Thus, when we take stock of the wood used in these buildings, little is found. Doors and windows, trim around them, baseboards, floors in main rooms of the apartment, wainscots, panel moulding strips, closet shelves and shelf strips, built-in kitchen furniture, and a few odd and end bits are of wood. But we have noticed that many of the best apartments use metal doors and trim, although this is not required by the building code, except when doors open into public halls and stair-wells.

But in spite of all these precautions against fire there remains the danger of a serious conflagration trapping the tenants within the upper floors, and so special arrangements for exits must be provided. Moreover, adequate stairways are necessary to permit the firemen quick access to any fires that may start in the upper floors of the building. An outstanding historical example of this was the fire in the Vanderbilt Building, in New York City, in which building there was a crooked stairway surrounding the elevator shaft. Although the fire was comparatively insignificant, yet the shaft was so filled with smoke that firemen were overcome while carrying the hose to the upper floors.

As in non-fireproof construction, so in a fireproof building, there should be provided two ways of escape for tenants in every apartment. The usual arrangement in New York City is to provide either one or two elevators and stairways for the main entrance to the apartments, and then secondary service stairs and freight elevators, or stairs enclosed in what is termed a fire-tower. These latter stairs, although enclosed in a fireproof well and built of fire-resisting material, are not lighted from the outside, and may become filled with smoke if some one of the self-closing fire-doors jambs and remains open in a time of fire. For real safety the smoke-proof tower, as described in one of the previous articles, should be erected as the secondary exit, but they are not required by law, and so are not built.

In addition to proper exits and construction, a fireproof apartment has certain auxiliary fire apparatus installed in it. Stand-pipes with hose connections are located in the public stair-halls throughout the building. These stand-pipes are connected with a tank on the roof, which is supposed to be kept full for emergency. Pumps, called fire-pumps, are installed in the basement to supply these tanks with water in the hose lines should the contents of the roof-tank be drawn off. This same system of piping is also connected with a pipe outside of the building on the street front, to which the fire-engines may connect their hose and pump in water. Hatchets, chemical extinguishers, buckets, and other auxiliary fire apparatus may be distributed in the building.

Special precautions are also taken to protect the flues of the heating boilers, which are usually very large and develop considerable heat. Iron stacks surrounded by 12-inch thick brick or hollow terra-cotta tile walls are customarily erected, enough space being left between the stack and the enclosing walls to allow for adjustments.

Another source of fire danger lies in the electric-wiring, and this is protected by rigid steel conduits carried through floors, walls, and partitions. Connections for fixtures and switches, and the like, are made with pressed steel outlet boxes, fastened to the ends of the conduits.

This completes our brief picture of the fireproof apartment, and we will consider in later articles the many details which are obviously involved.

Announcements

W. E. Gore, architect and engineer, registered architect State of Illinois and specialist in school design, is located now at 411 Realty Building, Louisville, Ky.

Samuel W. Carrington, architect, 502 Melba Theatre Building, Dallas, Texas, announces the opening of an office at the above address, and would like very much to receive manufacturers' cards, catalogue, and samples.

Toby Vece announces the opening of an office for the practice of architecture in the Wolcott Building, 817 Chapel Street, New Haven, Conn. Manufacturers' samples and catalogues are desired.

Delight Sweney Trimble, architect, has opened an office at 225 East Broad Street, Westfield, N. J., and desires catalogues to complete her files.

FLORENCE AND THE ARNO FROM SAN MINIATO. From the drawing in pastel by Wilbur A. Reaser.